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Volume 1

PICEANCE BASIN
Resource Management Plan
and Environmental Impact Statement

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U.S. DEPARTMENT OF THE INTERIOR
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White River Resource Area, Colorado
April 1984

IN REPLY REFER TO:

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NOTICE

Enclosed for your review and comment is the Draft Resource Management Plan and Environmental Impact Statement (RMP) for the Piceance Basin Planning Area. This Resource Management Plan is an attempt to integrate all resources into a single unified program of management after considering a reasonable range of alternatives. Your review and comments are needed at this time to ensure that your concerns have been considered in the planning process.

Please direct your written comments to the Piceance Basin RMP Team Leader, Bureau of Land Management, White River Resource Area, Post Office Box 928, Meeker, Colorado 81641. Written comments must be received by close of business on July 27, 1984. Also use this address when requesting further information on materials referenced in the Draft RMP.

Oral comments will be accepted at the following public hearings:

Date and Time	City	Location
May 15, 1984 7:00 P.M.	Meeker, Colorado	White River Resource Area Office 73544 Highway 64
May 17, 1984 7:00 P.M.	Grand Junction, Colorado	Ramada Inn 718 Horizon Drive
May 22, 1984 7:00 P.M.	Lakewood, Colorado	Ramada Inn Foothills 11595 West 6th Avenue
May 24, 1984 7:00 P.M.	Glenwood Springs, Colorado	Holiday Inn 51359 U.S. Hwy. 6 & 24

A time limit may be placed on oral comments, depending on the number of people who wish to make a statement. Oral comments should be accompanied by a written synopsis of the presentation. Written and oral comments, will be fully considered and evaluated in preparation of the proposed Resource Management Plan and Final Environmental Impact Statement.

If changes in the proposed Resource Management Plan and Environmental Impact Statement are minor, it will only include those changes and will not be a full reprint of the Draft RMP. For this reason, reviewers are requested to retain their copy of the Draft RMP for use in conjunction with the proposed RMP and Final Environmental Impact Statement.

Bob Moore
Acting State Director, Colorado

#10803063

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PICEANCE BASIN

RESOURCE MANAGEMENT PLAN

and

ENVIRONMENTAL IMPACT STATEMENT

Prepared by:

Bureau of Land Management

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PICEANCE BASIN RESOURCE MANAGEMENT PLAN

and

ENVIRONMENTAL IMPACT STATEMENT

Draft (X) Final ( )

The United States Department of the Interior, Bureau of Land Management

1. *Type of Action*: Administrative (X) Legislative ( )

2. *Abstract* : This draft resource management plan and environmental impact statement describes and analyzes five alternatives for managing the public lands and resources in the Piceance Basin Planning Area of the White River Resource Area, Colorado. They are: (1) Current Management Alternative, (2) Wildlife Alternative, (3) Oil and Gas Alternative, (4) Oil Shale Alternative, and (5) Preferred Alternative.

3. *Comments have been requested from the following*: See attached distribution list.

4. *For further information, contact*:

John Singlaub, Team Leader

Bureau of Land Management

White River Resource Area

PO Box 928

Meeker, Colorado 81641

Telephone (303) 878-3601

5. *Comments on the draft resource management plan and environmental impact statement must be received no later than*:

July 27, 1984

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Local Agencies

Associated Governments of Northwest Colorado
Eastern Rio Blanco County Parks and Recreation District
Western Rio Blanco County Parks and Recreation District
Garfield County
Grand County
City of Grand Junction
Town of Meeker
Mesa County
Moffat County
Pitkin County
Town of Rangely
City of Rifle
Rio Blanco County
Town of Silt
Summit County
Town of Walden

Other Organizations and Individuals

Over 1,000 organizations and individuals have also expressed interest in the resource management plan and have been sent copies for review and comment.

ACKNOWLEDGEMENT

Government publications seldom acknowledge the contributions of those individuals that have made the extra effort needed to complete the document. But this RMP has been special both because of the sensitive issues involved, and the unique automated system used to develop it. We thought it would be appropriate to recognize those individuals whose contributions to the RMP have been most important.

The List of Preparers included after Chapter V of this resource management plan lists the BLM employees that have been most deeply involved in the analysis and preparation of this plan. Their contributions to the document, big or small, have been invaluable, and each one should be recognized for the effort they have put forth to make this document a success. All of these individuals have met with the frustrations of preparing a multiple use plan within tight deadlines and budgets, to produce a plan we can all be proud of.

Numerous other individuals outside of BLM have also been closely involved with the preparation of the RMP. This plan is the first comprehensive land use plan in the Department of Interior that has been prepared using a completely digitized inventory and data base, and the analytical and graphic capabilities of a geographic information system. Most of the maps in this document, including the full color maps in the Map Addendum, are computer-generated. Considerable work has been required to implement this prototype effort, including software and hardware adaptation to the specific needs of this complex data base, and the data manipulation needs of the planning process. Particularly invaluable in this effort has been the Western Energy and Land Use Team (WELUT) of the U.S. Fish and Wildlife Service in Ft. Collins, Colorado. Their hard work and skilled assistance were critical to the preparation of the document. We don't have room to include the names of all those who helped, however, special thanks go to Don Hunter, Randy Frosh, and Jerry Stout of WELUT, and Lea Ann Sullivan, Donna Weyer and Barbara Duggan of Technicolor Government Services, Inc., on contract to WELUT.

Also critical to the development of the resource management plan were all those organizations, agencies and individuals commonly referred to as the PUBLIC. Numerous comments, reviews, workshops, meetings and discussions with the public have gone into the formulation and analysis of alternatives in the RMP. Several individuals stand out in their commitment to assisting us in developing a credible land use plan that genuinely attempts to achieve an acceptable compromise for the future management of the Piceance Basin. While most are probably not fully satisfied with the results (which, after all, is the sign of a successful compromise!), special thanks go to DeWitt John of the State of Colorado, Allan Jones of Rio Blanco County, Kevin Markey of Friends of the Earth, Mark Pearson of the Colorado Open Space Council, and Chris Treese, Cindi Coleman and Randy Threadgill of the Rocky Mountain Oil and Gas Association. Their advice and assistance in finalizing and fine tuning the Preferred Alternative greatly helped us in assuring responsiveness of the RMP to the concerns of the public.

Many more individuals were extremely helpful to us in completing this document. Their commitment to the planning effort was invaluable. The extra effort of all those involved should not go unrewarded, and so for that, we extend our heartfelt appreciation to all of you who made this document a success.

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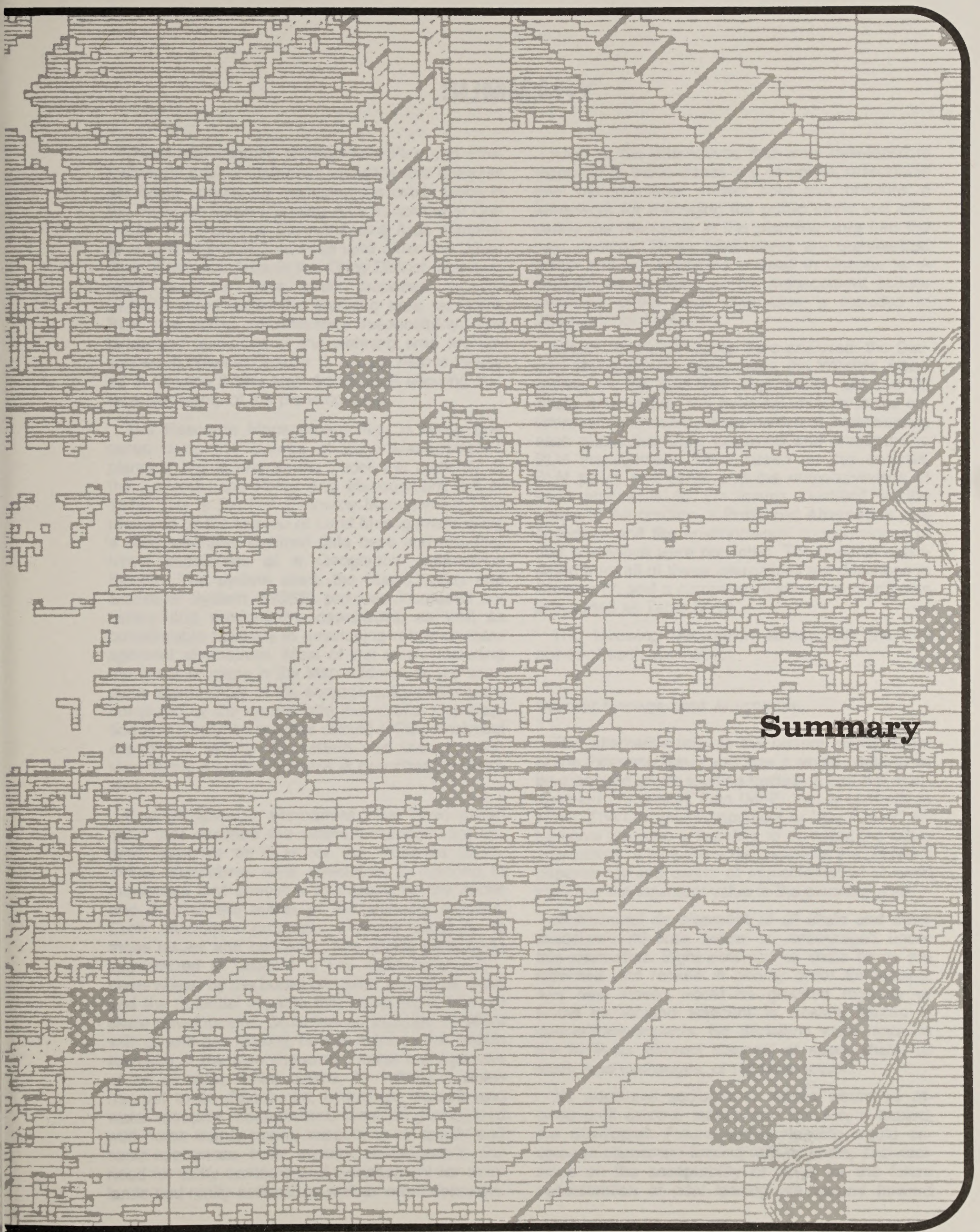
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Summary

SUMMARY

This draft Resource Management Plan and Environmental Impact Statement identifies and analyzes the future options for managing the public lands in the Piceance Basin Planning Area in northwest Colorado. The Piceance Basin Planning Area comprises a total of 804,580 acres of land within the White River Resource Area in the Craig District. Management decisions have been proposed for the 674,370 acres within the planning area for which BLM has some administrative responsibility. The lands and resources of the planning area are described in detail in Chapter II. A base map is included in Volume 2 (the Map Addendum) showing surface ownership of the planning area.

The Resource Management Plan is being prepared using the Bureau of Land Management's planning regulations issued under the authority of the Federal Land Policy and Management Act of 1976. This is the first Resource Management Plan prepared by the Bureau of Land Management using a comprehensive digitized data base and the analytical capabilities of a Geographic Information System. The system used, the Map Overlay and Statistical System (MOSS) provided increased accuracy and manipulative capabilities, as well as considerable flexibility in developing resource management alternatives. Most of the maps, including the full-color maps in the Map Addendum, are computer drawn. Most of the acreage calculations were computed by the system and the conflict identification and resolution process utilized MOSS analytical capabilities. Where the system was used in each step of the planning process is described in Chapter I.

Five multiple-use alternatives have been developed that describe the different management options available to BLM for the Piceance Basin. These alternatives were developed to respond to the issues and concerns expressed by the public and BLM at the outset of the planning process. Each alternative proposes different solutions to these issues and concerns. The issues have been summarized in Chapter I. The most critical concerns raised by the public centered around oil shale and the potential impacts that could result from oil shale development. Other issues included conflicts with oil and gas leasing; how to manage the wildlife resource in the planning area; interim management of the oil shale mining claims, the validity of which has yet to be determined; hydrologic impacts and water resource management; livestock grazing and wild horse management; impacts to air quality and socio-economics from mineral development; the need for utility corridors and management for other lands and realty actions; as well as other concerns.

Each of the alternatives that were developed in response to these issues is a complete, reasonable and implementable master plan that provides a framework for managing the public lands and allocating the resources in the planning area into the next century. These alternatives are summarized below and are described in detail in Chapter III. A comparative summary of the management actions proposed under each alternative is included in Chapter III as Table III-1.

Initially, four alternatives were analyzed: the **Current Management Alternative,** the **Wildlife Alternative,** the **Oil and Gas Alternative** and the **Oil Shale Alternative**. The potential impacts to the environment and nearby communities of implementing each alternative were examined and presented to BLM management. Then, based on this analysis, BLM policy and goals and the responsiveness of each alternative to the issues identified at the outset of the process, a **Preferred Alternative** was described and the environmental consequences of that alternative were predicted. The impacts anticipated from all of these alternatives are described in Chapter IV, and a comparative summary of impacts is included as Table IV-10.

The following description summarizes the key points of each alternative:

Current Management Alternative

This alternative reflects the current management of the Piceance Basin and how it would continue to be managed under existing decisions and the Management Framework Plan (MFP) that is currently in effect. The Current Management or "No Action" Alternative provides a baseline to compare the other alternatives. It includes a discussion of the demand, dependency and extent of implementation of each resource management value in the planning area.

Multimineral development of oil shale and other associated minerals would be encouraged under this alternative. Eight potential oil shale tracts are identified and ranked in priority order for leasing. Any new leases would be grouped together or would be located adjacent to existing leases to concentrate impacts. No decisions were made in the MFP for off-tract disposal of spent shale, oil shale land exchanges, or research tracts.

No additional sodium-only leases would be offered until existing leases and PRLA's, if leased, are developed. Future sodium leasing would encourage concurrent leasing with oil shale. The decisions on the acceptability of lands for the future consideration of coal leasing are carried forward

from the 1981 Coal Amendment to the White River MFP. That study examined the lands in the planning area with coal development potential and identified 29,610 acres of lands acceptable for underground development, of which 24,635 are also suitable for surface development. A comprehensive management program for oil and gas was established in 1981 for the White River Resource Area in an *umbrella* environmental assessment. The current process of approving applications for permit to drill, rights-of-way, exploration and development of oil and gas was formalized and made consistent in an effort to minimize surface disturbing activities caused by increased leasing. A 5-year plan of development would be requested from new lessees in an attempt to consolidate transportation needs.

Most of the planning area would remain closed to locatable mineral entry due to oil shale withdrawal. This decision would remain constant for all alternatives. Saleable minerals would be made available as requests occur, with site-specific stipulations applied on a case-by-case basis.

Water quality would be maintained at existing levels, and currently scheduled spring source and stream channel stability studies would continue. Recommendations on project restrictions to protect soils are made on a project-specific basis.

A 5-year sale plan for forest products identifying 2,500 cords of pinyon-juniper firewood and 250,00 board feet of Douglas fir sawtimber is in effect. The grazing management program, approved in 1980, is being implemented for the resource area. The current maximum authorized use in the planning area of 57,016 Animal Unit Months (AUMs) would increase to an allocation of 64,011 AUMs in the long-term.

A Wild Horse Herd Management Plan is in effect, with a herd objective of 100 horses for the planning area. The Piceance Basin Habitat Management Plan for wildlife would improve habitat conditions of recreational species, raptors and threatened and endangered species. A long-term allocation of 40,501 AUMs would be sought, which would achieve the joint objectives of BLM and the Colorado Division of Widlife.

No threatened or endangered plant speices are currently known in the planning area. Avoidance of known locations of rare and sensitive plants, and surveys to identify such plant locations prior to surface-disturbing projects, is current policy for these species.

The recreation program in the planning area is minimal, although extensive hunting use occurs annually. The entire planning area is currently open to Off Road Vehicle (ORV) use.

Major linear rights-of-way are encouraged to locate in potential utility corridors. Some 850 acres of land have been identified for potential disposal. Community expansion needs would be considered as proposed by local communities.

No fire management plan is currently in effect, although the need for one has been identified.

There are no existing Areas of Critical Environmental Concern (ACECs), Research Natural Areas (RNAs), or Outstanding Natural Areas (ONAs) in the Piceance Basin.

Wildlife Alternative

The goal of this alternative is to emphasize the management and use of the public lands for the benefit of wildlife and related values. Significant surface disturbing activities and other actions that would adversely affect important wildlife habitat would be discouraged. Management actions that serve to maintain or enhance habitat available to all wildlife would be encouraged. This alternative would result in a reduction in surface disturbing activities, improved forage, a maintenance of water quality, and the protection of fragile and productive soils. Other resource values that would benefit from these objectives would similarly benefit from implementation of this alternative.

No new open pit oil shale leasing would occur under this alternative. Multimineral development of oil shale and associated minerals would be encouraged. New oil shale leasing would be considered once the existing prototype tracts are developed and operating commercially. No more than one oil shale tract would be leased within any five year period. No new lands would be considered for off-tract disposal of overburden and spent shale. Exchanges would be considered within the lease limit of one tract every five years. Small research tracts would be evaluated on the merits of the technology and the availability of alternate private lands.

No sodium-only leasing would be allowed. Development of sodium minerals would be allowed only concurrently with oil shale. Coal leasing would be considered on a total of 29,610 acres for underground mining methods only. Leasing for surface mining would not be considered.

Known Geologic Structures would have priority for oil and gas development. Lands would be open for leasing and subject to the stipulations in the *Oil and Gas Umbrella Environmental Assessment*. New or reissued leases would be subject to additional stipulations for other critical resource values. Submission of a five year plan of development would be required for new or reissued leases.

Development of sand and gravel would favor existing sites, and would be excluded from areas of sensitive environmenal values.

Water resource inventories would be completed as scheduled. Water quality would be maintained, and where streams do not meet State Standards, management practices would be implemented to improve water quality. Sensitive watersheds would be identified and intensive management practices implemented to protect those watersheds. Productivity of the soil resource would be maximized, while disturbances on productive and fragile soil would be minimized. Restrictions would be applied to surface disturbing activities, including seasonal off-road vehicle restrictions on saturated roads.

As in the Current Management Alternative, the 5-year sale plan for forest products would be implemented. The 1980 grazing management decisions for livestock grazing would also be implemented. The wild horse herd would be reduced to some 65 to 100 animals from the current 159.

Wildlife management would be optimized in this alternative. Intensive management practices on wildlife habitat would be implemented to increase the long-term allocation to wildlife to 48,632 AUMs, which exceeds existing population objectives.

All known populations of rare and sensitive plants and remnant vegetation associations would be protected through avoidance or no surface occupancy stipulations designed to exclude surface disturbing activities.

Intensive management of recreation user areas and services would occur in this alternative. Hunter camps and access would be improved, a seasonal visitor services program for hunters would be established, as would a non-motorized hunting area. Public access to the White River would be improved. Hunter concentration areas would be proposed as Special Recreation Management Areas. Seasonal and permanent off-road vehicle closures and restrictions would occur based on non-motorized hunting, soils, watershed and Special Management Area designations. A Recreation Management Plan would be developed to describe proposed management in the Special Recreation Management Area.

Twenty utility corridors would be designated in this alternative. These corridors are designated for special uses for which additional environmental analysis is unnecessary, thereby encouraging the location of major linear utilities within them. In addition to the 850 acres potentially suitable for disposal, additional criteria would be established to analyze future lands for sales or exchange. Community expansion sales or leases would be considered for public lands within a three mile radius of the communities of Rangely and Meeker.

A fire management plan would be prepared under this alternative, while prescribed burns would continue as determined in the White River Management Framework Plan.

Twelve Special Management Areas would be designated as ACECs, ONAs, and RNAs, totalling some 23,965 acres of the Basin.

Oil and Gas Alternative

This alternative places management emphasis on planning and providing for oil and gas development and transportation. It also places management priority on providing access to the public lands for other resource values including forest products, off-road vehicle use and major linear rights-of-way. Management actions would be taken to assure access to the public lands for a wide variety of uses.

Stipulations would be placed on oil shale leases to permit the orderly development of oil and gas resources. The multimineral zone in the depocenter of the Basin would be reserved from oil shale leasing until improved resource recovery technology is proven. Open pit mining and underground mining would be allowed outside the multimineral zone. Leasing would be excluded from the Piceance Dome area due to the high oil and gas values there. Future oil shale lease offerings would be based on demand, and the progress and success of existing leases. No more than two oil shale tracts would be leased during any five year period. Off-tract disposal of spent shale would be permitted within legal constraints, provided oil and gas recovery is not affected. Oil shale land exchanges would be subject to the same number and locational restrictions as oil shale leasing. Research tracts would be considered on the merits of the technology proposed.

Sodium-only leases would be considered once existing leases and PRLAs are developed. Coal leasing would favor underground methods on the 29,610 acres identified as acceptable for further consideration for coal development. Coal lease stipulations would be included assuring the future extraction of the oil and gas resource.

Known Geologic Structures, Tight Gas Formations and a two mile buffer around those areas would have priority for oil and gas. Stipulations would be placed on future oil shale leases to allow for the development of oil and gas. A five year plan of development would be requested for new or reissued oil and gas leases.

A mineral materials inventory would be conducted to identify the best areas for sand and gravel development. Development would be excluded from mandatory protection areas.

Water resource inventories would be completed as currently scheduled. Some limited management practices would be utilized to maintain water quality and improve substandard streams. Sensitive watersheds would be identified and efforts to improve such watersheds through intensive management practices would be implemented through watershed management plans. Areas of accelerated soil erosion would be stabilized and rehabilitated. Management practices would be implemented to impede deteriorating soil conditions.

Forest product sales would be increased to some 4,000 cords of firewood and 300,00 board feet of sawtimber annually. The 1980 grazing management decisions would be implemented for livestock grazing, and the wild horse herd would be reduced to 65 to 100 animals.

Implementation of habitat management practices for wildlife would be limited, however, a long-term allocation of 40,501 AUMs would be sought.

Known populations of rare and sensitive plant species would be protected where possible from surface disturbing activities.

A Non-motorized Hunting Area would be established as a Special Recreation Management Area. Off-road vehicle closures would be implemented in that area and in three designated ACECs, and seasonal closures would be implemented to protect the soil resource. The remainder of the planning area would continue to be open to off-road vehicle use. A Recreation Area Management Plan would be prepared to identify management of the Special Recreation Management Area.

Utility corridors would not be designated in this alternative, however, the potential corridors identified in the White River Management Framework Plan would remain and major linear rights-of-way would be encouraged to locate in them. The 850 acres of lands identified as potentially suitable for disposal would be considered for sales or exchanges, plus additional criteria would be established to analyze future lands for disposal. Community expansion sales or leases would be considered within a five mile radius of Meeker and Rangely.

A fire management plan would be prepared under this alternative, while prescribed burns would continue as specified in the White River Management Framework Plan.

Three priority Special Management Areas would be designated as ACECs or RNAs, totalling 5,745 acres.

Oil Shale Alternative

Management emphasis in this alternative would be placed on the development, production and transportation of oil shale and associated minerals on the public lands in the planning area. Priority would be placed on making lands available for commercial oil shale leasing by private industry as demand and economics dictate.

Oil shale leasing would make available lands for different kinds of oil shale development -- multimineral, open pit and underground. Multimineral leasing would be required in the multimineral zone. Most of the area containing oil shale would be available for leasing. Lease offerings would be considered at least every five years. The number of leases and the timing of leasing would take into consideration the limitations of the carrying capacity of the environment and nearby communities. Dispersed leasing would be encouraged so as not to concentrate impacts. Off-tract disposal of spent shale would be considered as proposed within existing legal constraints. Oil shale land exchanges would also be considered as proposed, but would be included in the carrying capacity limits. Research tracts would be considered as proposed.

No sodium-only leasing would occur, only concurrently with oil shale leasing. All coal lands determined to be acceptable for leasing would be available for future leasing. Some 29,610 acres have been identified as suitable for underground coal development; of this, 24,635 acres are also acceptable for surface mining.

Known Geologic Structures and high priority Tight Gas Formations would be areas of the most oil and gas development. Stipulations would be applied to oil and gas leases within the oil shale management priority area to protect the oil shale resource. A five year plan of development would be required for new or reissued leases.

A mineral materials inventory would be conducted to identify the best areas for sand and gravel development. Development would be excluded from mandatory protection areas.

Water resource management would be the same as described for the Oil and Gas Alternative. Soil conditions would be maintained through the use of standard stipulations on surface disturbing activities.

Forest product sales would be reduced to 1,000 cords of firewood and 100,000 board feet of sawtimber annually. Use adjustments would be necessary on livestock grazing adjustments as oil shale development occurs. Otherwise, the 1980 grazing management decisions would be implemented.

The wild horse herd would be reduced to 65 horses. Further use adjustments may be necessary as oil shale development occurs. The wildlife habitat management plan would be amended to reflect increased pressure from oil shale development. Long-term forage allocations would be 36,253 AUMs for wildlife. Use adjustments for wildlife may also be necessary when oil shale development occurs.

Known locations or rare and sensitive plants and remnant vegetation associations would be avoided where possible.

The intensive recreation management practices identified in the Wildlife Alternative would be implemented. In addition, a regional ORV play area would be established and a hunter/ORV information map developed.

No utility corridors would be identified in this alternative. Criteria would be established to avoid sensitive resource values when locating major linear rights-of-way. Priority would be given to processing use authorizations associated with energy and mineral development. Lands considered for disposal would not include those with any energy/mineral development potential. The 850 acres identified as potentially suitable for disposal would be supplemented by additional criteria to be used in considering future lands for sales or exchange. Community expansion sales or leases would be considered for lands within a seven mile radius of Meeker and Rangely, and within a three mile radius of Rio Blanco and White River City if determined necessary by local officials.

A fire management plan would be prepared under this alternative, while prescribed burns would continue as specified in the White River Management Framework Plan.

No Special Management Areas would be designated under this alternative.

Preferred Alternative

This alternative achieves the combination of management options that is the most acceptable resolution of the planning issues identified at the outset of the planning process. The alternative attempts to balance all land uses and resource values considering the impacts of all management options and the long-term public interest and benefits of implementing the alternative.

This alternative would allow for additional open pit oil shale leasing within the open pit zone if and when off-tract disposal needs can legally be met. The multimineral zone in the depocenter of the Basin would be reserved from oil shale leasing until improved oil shale recovery can be proven. Within Known Geologic Structures, stipulations would be placed on oil shale leases assuring the recovery of oil and gas. Outside of Known Geologic Structures, oil shale would have priority. The Piceance Dome area would be excluded from future oil shale leasing. A sequential lease offering process would be followed whereby critical carrying capacities for air quality, water quality, wildlife and socio-economics would not be exceeded. Real impacts from development would be monitored to assure that additional leasing does not exceed these carrying capacities.

Future off-tract disposal of spent shale would be considered if legislatively authorized. Oil shale land exchanges would be subject to the same constraints of carrying capacity and location as oil shale leasing. Priority would be given to small exchanges to support private development, while exchanges of large blocked up Federal lands would be discouraged. Small research tracts would be evaluated on the merits of the technology proposed and the availability of alternate private lands.

Sodium-only leases would be allowed once existing leases are developed, however they would not be allowed if the recoverability of the oil shale resource would be reduced. Multimineral recovery would be encouraged once the multimineral zone is made available for leasing. A total of 29,610 acres of coal lands would be available for underground coal leasing, of which, 24,635 acres would also be acceptable for surface mining.

Oil and gas leasing would be subject to the stipulations of the Oil and Gas Umbrella Environmental Assessment. Priority would be given to oil and gas in Known Geologic Structures. A five year plan of development would be requested for new or reissued leases to consolidate oil and gas transporation needs.

A mineral materials inventory would be conducted to identify those lands with best potential for sand and gravel development. Such development would not be permitted in mandatory protection areas, while existing or previously used sites would be favored.

The water resource inventories would be completed as scheduled. Watershed management plans would be developed to identify management practices necessary to maintain or improve water quality. To the extent possible, groundwater quality or quantity would not be degraded. Spring reliant uses supplied by groundwater would have to be mitigated if impacted. Monitoring of these impacts and stipulated mitigation measures placed on mining activities would be implemented by lessees or through an industrial association. Sensitive watersheds would be protected through restrictions

such as seasonal road closures. Development on steep slopes and erosive or saline soils would be avoided where possible. Management practices would be implemented to protect, maintain or improve the quality of the soil resource.

The 5-year sale plan for forest products would be implemented, providing some 2,500 cords of pinyon-juniper firewood and 250,000 board feet of Douglas fir sawtimber annually. The 1980 grazing management decisions would be implemented, providing for a long-term allocation of 64,011 AUMs for livestock grazing. Use adjustments may be necessary to accommodate oil shale development.

The Wild Horse Herd Management Plan would be implemented. The herd management objective for the Piceance Basin would be 100 animals. The Wildlife Habitat Management Plan for the Piceance Basin would be implemented to improve habitat conditions of recreational species, raptors and threatened and endangered species. Long-term allocations to wildlife would be 40,501 AUMs, which would achieve the objectives of BLM and the Colorado Division of Wildlife. Use adjustments may be necessary to accommodate oil shale development.

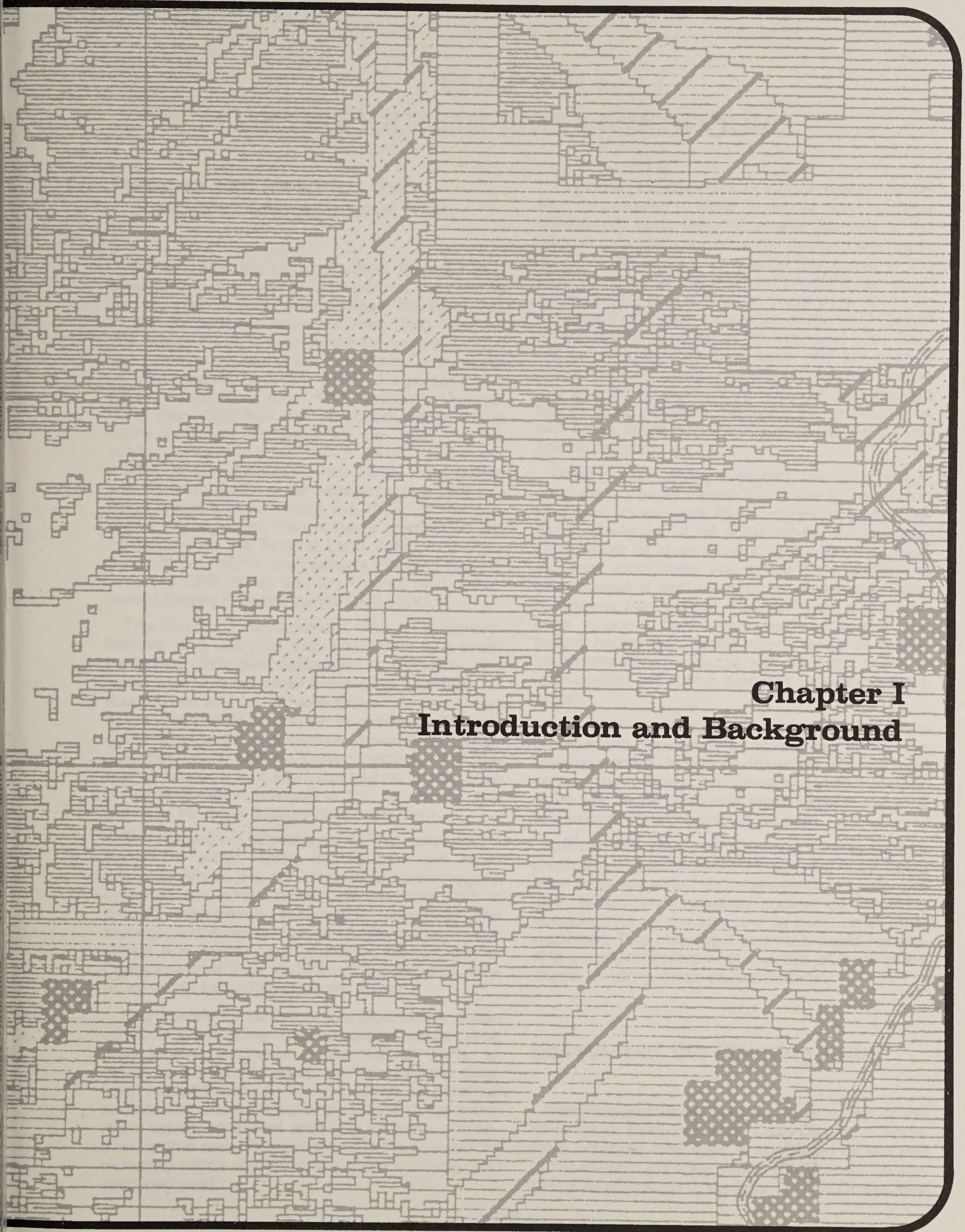
Known locations of rare and sensitive plants would be avoided where possible. Surveys would be performed in areas of potential habitat. Certain populations of rare and sensitive plants would be fenced, monitored or protected with avoidance or no surface occupancy stipulations.

More intensive recreation management practices would be implemented. These would include management of use areas, improved access, provision of seasonal visitor services for hunters, and improvement of public access to the White River. A Non-motorized Hunting Area would be established as a Special Recreation Management Area. Seasonal and permanent ORV closures would occur based on non-motorized hunting, watershed, soils, wildlife and ACEC designations. A Recreation Area Management Plan would be prepared for the Special Recreation Management Area.

Sixteen utility corridors would be designated for major linear rights-of-way. Utilities would be encouraged to locate within these designated corridors through the incentive of reduced environmental analysis requirements. Additional criteria are established for locating major utilities outside these corridors. The 850 acres identified as potentially suitable for disposal would be available for sale or exchange. Additional criteria would be established for future land disposal consideration. Community expansion sales or leases would be considered within a five mile radius of Meeker and Rangely. If growth in these communities increases too dramatically for these communities to accept, and it is determined by local officials that development is required outside existing communities, Rio Blanco and White River City should be considered as logical sites for new community development.

A fire management plan would be prepared and implemented under this alternative. Prescribed burning would continue as specified in the White River Management Framework Plan.

An area of some 160 acres would be designated as an Area of Critical Environmental Concern in the Soldier Creek area. Management of all areas that were proposed for special management designation in the other alternatives is prescribed to protect the significant values identified for those areas.



Chapter I
Introduction and Background

CHAPTER I
INTRODUCTION AND BACKGROUND

Purpose and Need for the Resource Management Plan

In May 1982, the Colorado State Director, BLM directed that a Resource Management Plan (RMP) be prepared for the Piceance Basin Planning Area of the White River Resource Area. The intent of this directive was to incorporate the necessary land use planning decisions for a long-term, commercial oil shale leasing program within the context of a broad, multiple-use plan. The Resource Management Plan describes the framework within which future land use decisions will be made for the public lands within the Piceance Basin. An environmental impact statement has been incorporated into the plan, fulfilling the requirements of the National Environmental Policy Act (NEPA). The Resource Management Plan is being prepared in accordance with the Federal Land Policy and Management Act, NEPA, the Bureau's Planning Regulations (43 CFR 1600), and the Council on Environmental Quality Regulations (40 CFR 1500).

The Resource Management Plan is a comprehensive land use plan that establishes land areas for limited, restricted, designated or exclusive uses within the planning area. It identifies allowable resource uses and related levels of production or use to be maintained, resource condition goals, program constraints, and general management practices needed to achieve these objectives. The Resource Management Plan establishes a sequence of implementation, support action necessary, and the need for more detailed or specific plans.

The Resource Management Plan provides a framework within which management will make future decisions. It is not intended to make program decisions for individual resource elements, but to provide the overall multiple-use objectives and management direction for the planning area. In this sense, it is similar to a traditional Master Plan or Comprehensive Plan, that identifies policy and criteria by which future decisions are made.

This framework for future management is established by determining which resources will be given management emphasis in the various parts, or management priority areas, of the planning area. Each management priority area allows for other resources to be developed or protected to the maximum extent consistent with the resource emphasized in that area. Resource development would be managed within the principles of multiple-use and sustained yield.

Originally, the RMP was to include sufficiently detailed information to allow leasing of oil shale tracts immediately upon completion and approval of the plan. In July 1983, however, the decision was made by the BLM Director to change the scope of the RMP so that only management priority areas would be described; oil shale lease tracts were not to be delineated until after completion of the RMP. Based on the decisions made in the approved plan, BLM will go through tract delineation and site-specific environmental impact statements prior to leasing any specific oil shale tracts. This decision brought the oil shale resource decisions into conformance with those made for other resource values considered in the plan.

Dividing the planning area into different management priority areas makes it possible to know what to expect for any resource in any given area. A potential developer of oil shale would, for example, know where oil shale development is favored (have the least restrictions) and where more restrictions are required if that resource is developed. Utility companies can look at the RMP map and determine where a right-of-way would encounter the fewest restrictions. Areas where range or wildlife improvements could occur with the least threat of later conflict with other resource development are shown.

The BLM has assured that everyone has been provided the opportunity to have a say in how the Piceance Basin should be managed into the next century by inviting the general public resource users and local, state and other Federal agencies to participate in this planning process.

Without this plan, any proposed development or protection of resources in the planning area would have to be examined on a case-by-case basis, with each action being weighed against all the other possible uses for the area and its effect on all other resources. This piecemeal approach would not provide a comprehensive or cumulative analysis of the effects of taking these various actions.

Location of the Planning Area

The Piceance Basin Planning Area is part of the White River Resource Area, Craig District, in northwest Colorado. The area is comprised of 804,580 acres of land primarily within Rio Blanco County, with a small portion in Garfield County. Of this total

land area, BLM administers 604,490 acres of surface lands or approximately 75 percent of the planning area. Approximately 169,160 acres or 21 percent of the planning area is privately owned land located mainly along the major drainages that feed into Piceance Creek and the White River. The Colorado State Division of Wildlife administers 26,770 acres or 3.3 percent of the planning area used primarily for game management, wildlife studies and public hunting. The U.S. Department of Energy manages the remaining 4,160 acres of the Naval Oil Shale Reserve in the extreme southeast corner of the planning area.

The mineral rights within the planning area are primarily owned by the Federal government and are administered by the BLM. Total mineral lands managed by the Bureau comprise 674,370 acres or 84 percent of the planning area. All lands where BLM manages either the surface or the minerals or both are included in the planning decisions in this Resource Management Plan. Table I-1 shows a breakdown of the surface ownership of the land included within the planning area. Table I-2 shows the mineral ownership.

TABLE I-1

SURFACE LAND OWNERSHIP

Ownership	Acres in Rio Blanco County	Acres in Garfield County	Total	Percent of Planning Area
Private	102,970	66,190	164,160	21.0
State (Colorado Division of Wildlife)	26,770	--	26,770	3.3
Bureau of Land Management	551,540	52,950	604,490	75.2
Dept. of Energy (Naval Oil Shale)	0	4,160	4,160	0.5
Total	681,280	123,300	804,580	100.0

TABLE I-2

MINERAL OWNERSHIP

Ownership	Acres in Rio Blanco County	Acres in Garfield County	Total	Percent of Planning Area
Federal - Oil and Gas Only	3,390	210	3,600	.4
Federal - Coal Only	3,480	0	3,480	.4
Federal - All Minerals	581,880	60,860	642,740	79.9
Federal - Oil, Gas and Coal Only	580	0	580	.1
Other Federal	181,760	5,210	23,970	3.0

TABLE I-2—Continued

MINERAL OWNERSHIP

Ownership	Acres in Rio Blanco County	Acres in Garfield County	Total	Percent of Planning Area
Private or State Minerals	73,190	57,020	130,210	16.2
Total	681,280	123,300	804,580	100.0

The Piceance Basin Planning Area is bounded by the White River in the north; State Highway 13/789 to the east; the Roan Plateau and the Grand Junction District, BLM, on the south; and the Cathedral Bluffs to the west.

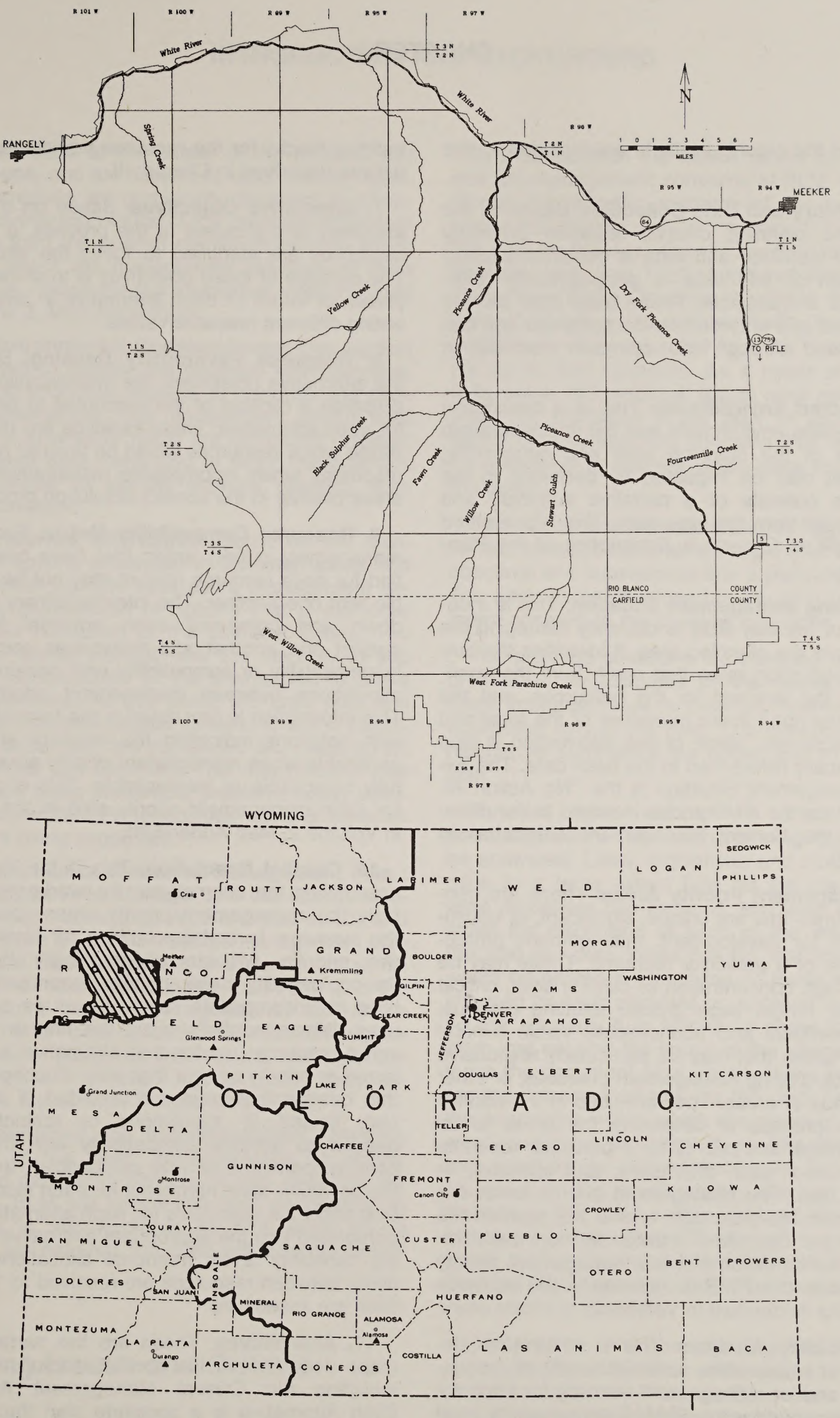
Figure I-1 shows the location and boundaries of the planning area. There is a more detailed base map of the planning area in the Map Addendum showing surface land ownership.

The Planning Process

The Bureau planning process has been designed to accommodate the issues and concerns of the public, while complying with the laws and policies established by Congress and the Department of the Interior. The process includes several mandated steps as established in 43 CFR 1600. For application in the Piceance Basin Resource Management Plan, these steps were expanded and modified to accommodate the unique resource management considerations of the planning area and the digitized data base that is available. All required steps are included.

The following components of the planning process were established for development of the Piceance Basin RMP.

1. Issues and Planning Criteria: The issues are the problems, concerns or opportunities identified by the public or BLM at the outset of the planning process, and which should and can be addressed through the RMP. The planning criteria are the set of guidance statements that direct the resolution of the issues through the planning process. They can be in the form of limits or constraints, or can be statements of goals or standards to be achieved. The planning criteria are intended to focus the planning effort, reduce the collection and analysis of unnecessary information, and facilitate subsequent analysis and decision making. Both the



PICEANCE BASIN PLANNING AREA

Figure I-1

issues and the planning criteria are included in this chapter.

2. Inventory and Data Collection: Based on the issues and planning criteria, resource inventory needs are identified and data is collected accordingly. Much of this data is geographically referenced and is mappable. These base data themes are digitized and entered into the computer and can be accessed through the computer terminal in Meeker.

3. Affected Environment: This is a description of the physical environment and the socioeconomic conditions of the planning area and surrounding region that may be impacted by decisions in the plan. This consists of a narrative summary and maps derived from the base data. This is presented in the RMP as Chapter II, Description of the Planning Area.

4. Existing Management Situation: This is a description of the way BLM is currently managing the resources in the planning area. It identifies the outputs or production rates that result from that management, the demand for the resources, and the dependency upon those resources of the local and regional economy. Much of this information is also geographically referenced in the base data. The Existing Management Situation is the "No Action Alternative" for the RMP and is included in the document as the Current Management Alternative in Chapter III.

5. Management Priority Areas: These are geographic zones that are unique, significant, or unusually suited for development, management, protection or use of a particular resource. These may be areas of high concentration of cultural sites, critical mule deer range, sage grouse strutting grounds, easily accessible and economically viable mineral deposits, areas that may be particularly responsive to livestock grazing management practices, or other similar kinds of areas. They are used in the conflict resolution process to determine the areas to be given management priority for a particular resource element under each alternative, and ultimately in the final plan. The management priority areas are derived from the base data and at this point in the process are described individually for each resource. The definition of each management priority area used in this RMP is included in the narrative for the Map Addendum in Volume 2.

6. Capability Analysis: This is a narrative description of reasonable, potential levels of production, use and/or management intensity for each resource managed by the BLM. Each capability level describes a different opportunity for BLM to manage that resource. These narratives are used with the Management Priority Area Maps as the building blocks for the resource management alternatives described in Chapter III.

7. Alternative Objectives: Based on the issues identified at the outset of the process, a range of objectives are identified to focus the alternatives. The purpose of these objectives is to show the emphasis or intent of each alternative in terms of favoring different resource values.

8. Resource Favorability Ranking: Based on the alternative objectives, the interdisciplinary team prepares a ranking of the resources to be favored for each alternative. These rankings are used to indicate which resources would be favored over other resources when incompatible management priority areas overlap in the conflict resolution process.

9. Resource Compatibility Matrix: Each of the management priority areas that have been identified for each resource may or may not be compatible with one another. The interdisciplinary team sits down and compares each potential land use against one another and determines compatibility, incompatibility or compatibility with certain limits or stipulations between management priority areas. This information is presented in the form of a matrix with notations indicating the limits or stipulations applicable when management priority areas are not fully compatible or incompatible. This is described for each management priority area in the narrative in Volume 2, Map Addendum.

10. Conflict Resolution: This is the key step in assembling the alternatives. By overlaying sequentially the management priority areas according to the resource favorability ranking for each alternative, priorities will vary geographically. By utilizing the compatibility matrix, conflict zones can be identified for incompatible uses, as well as compatible uses. Where conflicts arise, the first or more favored resource use for that alternative is the preferred or priority use for that area. Succeeding uses that overlap that zone are excluded (if incompatible), limited (if stipulations or restrictions are needed to achieve compatibility with the priority use), or permitted (if fully compatible). In addition, the capability level narratives for each resource that best meet the objectives for each alternative are incorporated into the appropriate alternative. Conflicting capability levels (resource allocations or land uses) between resources are resolved as the narratives are assembled.

11. Alternatives: These are the narratives and maps derived from the conflict resolution process, including the Current Management Alternative. Each Alternative is a complete plan that provides management with a framework to make future decisions, or to develop subsequent plans. They are all realistic and implementable, are responsive to the

issues identified at the outset of the process, are multiple-use, and are subject to valid existing rights. The alternatives are graphically displayed by showing the overlaying results of the management priority areas from the conflict resolution process which visually depict the management priorities of each alternative. These are the alternative maps included in Volume 2, Map Addendum.

12. Environmental Consequences: This section is intended to identify the potential environmental, social and economic impacts of implementing each of the alternatives. The management priority area maps and alternative maps are compared (overlaid to the base data maps and to other management priority areas) to identify impacts resulting from each alternative.

13. Preferred Alternative: Based on the management options presented in the alternatives and the potential impacts from each, management selects the combination of options that is the most acceptable resolution of the planning issues. The computer allows management the flexibility to see different combinations of the alternatives to arrive at the preferred. At this point, the draft plan and draft environmental impact statement, which constitute this document, are completed and released for public review and comment. This may result in new information being presented, problems being pointed out in the BLM Preferred Alternative or other alternatives being suggested.

14. Selection of Resource Management Plan : The Resource Area Manager and the District Manager evaluate comments received and select and recommend a proposed resource management plan to the BLM State Director. If this plan is not within the range of alternatives in the draft RMP and the environmental impacts are significantly different, a new draft RMP must be prepared. After review, the State Director publishes and files the RMP with the Environmental Protection Agency. It is then approved no earlier than 30 days after filing.

15. Monitoring and Implementation: Following approval of the RMP, implementation of activity plans and monitoring impacts of plan decisions will continue. BLM will review the plan periodically to assure it is still workable as time goes on. If changes are required, the RMP will be amended or revised.

Planning Issues and Criteria

As stated in the preceding section, the first step in the planning process was to identify the issues and concerns that need to be resolved in the plan. This includes both the issues raised by the public and the management concerns of BLM. In order to identify the specific concerns of the public, BLM held issue identification (or "scoping") meetings for the plan in Meeker, Grand Junction and Denver, Colorado in August 1982. Additional informal workshops were held in Boulder, Glenwood Springs and Rifle, Colorado in September 1982. Written comments were also requested from the public to identify issues and concerns. As a result of these efforts, some 180 individual issues were raised by the public for resolution in the plan. In addition, BLM added the management concerns that were felt to be necessary to address which were not raised by the public.

The issues that were identified as appropriate to be addressed in the plan were grouped into similar concerns and summarized into a planning question. The alternatives developed in the plan provide different answers to the planning questions.

The planning questions are intended to be comprehensive restatements of the issues identified. Each individual issue is retained, however, and is addressed fully in the plan. The questions are formulated to summarize the issues and to focus the plan.

For each of the issues, certain constraints or opportunities define how each planning question can be answered. Laws, regulations and policies determine to a large extent how far the plan can go, what processes can be used, and what limits constrain the discussion of each of the issues within the land use plan. While it is felt that little purpose would be served in identifying all these constraints imposed by each standard or guideline for each resource element, it is helpful to know the parameters that will limit the scope of the alternatives and focus the document as a whole. These parameters are the "planning criteria" for the plan. They define the constraints within which the planning questions are answered in the alternatives. The planning criteria may not be comprehensive for individual resource elements in the plan, although such resource-specific criteria exist. Instead, the planning criteria included here are those that are broader in scope and are appropriate for the level of detail of the plan. The planning criteria have been listed for each planning question.

Listed below are the planning questions and planning criteria identified at the outset of the planning process for the Piceance Basin plan. A full listing of the issues identified for the plan, and the issues not to be addressed in the plan is available from the the White River Resource Area office upon request.

It should be noted that when the original scoping and issue identification process for this RMP was conducted, BLM had intended to develop sufficiently detailed analysis to permit oil shale leasing directly following approval of the RMP. When the decision was made to have a two-tiered planning process whereby site-specific analyses on oil shale tracts follow the RMP (discussed previously), the scope of the RMP changed significantly. Many of the planning questions and criteria listed below were identified for the site-specific level of analysis and are not applicable to the broader level of planning of this RMP. We have included these questions and criteria anyway, and will be carrying them forward as appropriate for scoping issues for the EIS on the first round of oil shale leasing following approval of the RMP.

Planning Process

1. *What is the level of detail to be addressed in the RMP? What is the study area?*

a. The RMP is intended to provide a framework for management of the public lands in the Piceance Basin. It will guide the land uses in the basin, but will not necessarily be the final step in the planning process.

b. The need for subsequent resource-specific planning shall be identified in the RMP.

c. Management decisions will only be made for public lands in the Piceance Basin Planning Area. Significant environmental, social and economic impacts resulting from those decisions will be identified wherever they occur.

2. *How will the RMP address carrying capacity?*

a. The Federal Land Policy and Management Act specifies that the RMP consider potential uses of the public lands. These potential uses are restricted by upper limits or capabilities of the lands and environment to support such uses. These will be identified where they are critical to the decisions to be made.

b. The current BLM planning regulations identify "critical threshold levels" as a factor to consider in developing alternatives.

c. Limits to the ability of a community or the natural environment to accommodate growth or development shall be identified where possible. Management decisions shall be constrained by those limits to the extent they can be clearly identified.

d. The ability of BLM or other authorities to alter management practices to accommodate these thresholds or critical carrying capacities through mitigation measures or other invention shall also be identified.

3. *What assumptions will be made to formulate the baseline?*

a. Existing BLM management will be assumed for the No Action Alternative.

b. Proposed projects in the region that are felt to have a likely chance of completion within the foreseeable future will be assumed in the baseline.

c. Existing projects in the region are assumed.

d. The development methodology assumed for future oil shale leasing will be appropriate for the geologic structure in which development is projected.

e. Best available environmental control technologies will be assumed.

f. The environmental analysis will include the baseline and will be cumulative.

4. *What alternatives will be analyzed in the RMP?*

a. Decisions have already been made through the planning and NEPA processes for rangeland management, wilderness and coal in the Piceance Basin. These decisions shall remain intact except where they conflict with alternatives developed in this plan.

b. The RMP will not duplicate environmental analyses, but will incorporate by reference or summarize them as appropriate.

c. Alternatives will be structured and described as required by FLPMA and NEPA and their implementing regulations.

d. Alternatives will be issue-driven.

e. Each alternative will be a reasonable and implementable land use plan, reflecting the principles of multiple use and sustained yield.

f. A preferred alternative will be identified by the District Manager and approved by the State Director after evaluating the effects predicted for each of the alternatives.

5. *What methodology and guidance will be used for analysis and to direct the preparation of the RMP?*

a. The RMP will follow all guidance provided by FLPMA and NEPA and their implementing regulations. All other applicable laws and regulations that direct the treatment of specific plan or resource elements will also be followed.

b. A preplanning analysis was approved in September 1982 to further describe the roles,

responsibilities, scope and anticipated end products of the RMP.

c. The priority use zoning concept, with some modifications, will be used as the means of formulating alternatives.

d. Additional discretionary guidance for document preparation is developed as necessary.

e. Existing guidance will be used to identify and designate special management areas (areas of critical environmental concern, research natural areas, outstanding natural areas, etc.) in the RMP.

Inventory

1. *What additional resource data is needed to perform the analysis in the RMP, and how will it be gathered?*

a. Several inventory contracts were issued in 1981-1982 for various studies of the Piceance Basin. The results of these studies will be used for analysis in the RMP. The remainder of inventory data used is existing information in the Resource Area.

b. Existing data is current, accurate and complete for most resource values.

c. Significant data gaps will be identified by resource specialists and additional inventory conducted if deemed essential for the RMP.

d. Data will be obtained from other sources as necessary.

Air Quality

1. *What is the present air quality in the region and how will it be affected by oil shale and other development in the Piceance Basin? How will BLM predict these impacts?*

a. Take positive steps to mitigate impacts on air quality and to monitor air quality in areas of intensive use.

b. Require monitoring of Air Quality Related Values (AQRVs) in areas of intensive use and wilderness areas.

c. Identify the existing air quality, air basin, and air movement of the Piceance Basin.

d. Predict air quality pollutants and concentrations through an accepted air quality modeling procedure.

2. *What is BLM's role and authority in air quality management in the Piceance Basin?*

a. Ensure that BLM activities and BLM-authorized activities comply with all local, State and Federal air quality standards and regulations.

b. Assure that management practices have minimal adverse impact to air quality.

c. The Bureau's Air Resource Management Program is authorized under the Federal Land Policy and Management Act, the Clean Air Act (as amended), and the National Environmental Policy Act.

Oil Shale

1. *What environmental baseline data gathering and monitoring should be required of oil shale lessees prior to and during development?*

a. Determine those environmental elements that should be monitored, identified or evaluated by future oil shale lessees.

b. Utilize experience gained in the prototype oil shale program and other studies to make this determination.

c. Require comprehensive baseline studies in oil shale leases to assure adequate assessment of potential impacts of the mine plans.

d. Seek cooperation of Federal lessees, private land developers, and other agencies in developing a regional baseline and impact monitoring system.

2. *What mining method is appropriate for different management priority areas for oil shale? What are the different environmental impacts of each mining method?*

a. Identify a range of potential oil shale development scenarios for the Piceance Basin. Include different development patterns, timings of lease sales and development, and ultimate oil shale production rates.

b. Identify the full range of environmental, social and economic impacts that would result from the different levels of development proposed.

c. Determine the appropriate environmental safeguards or mitigation measures necessary for each oil shale management priority area.

d. Identify areas where open pit, multimineral or underground oil shale development is most appropriate and should be given management priority.

Mining Claims

1. *How will contested unpatented oil shale mining claims be treated in the RMP?*

a. Determine the appropriate land uses and management activities for the contested oil shale mining claims for interim management, and for subsequent management if validity of these claims is successfully contested.

Minerals

1. *How will the development of oil shale affect other mineral resources in the Piceance Basin? How should those other minerals be managed?*

a. Provide appropriate mitigation to protect mineral resources from the development of intermingled, comingled or otherwise associated minerals.

b. Identify areas where significant deposits of oil, gas, sodium, uranium, sand, gravel, coal and other minerals exist.

c. Where possible, prioritize all mineral (oil and gas, oil shale, coal, gravel, etc.) development into a logical sequence to prevent the waste of one mineral for another.

d. Identify areas where valuable resources must be protected from the effects of mineral development.

e. Determine those areas which could be developed or explored with appropriate restrictions.

f. Identify withdrawn areas no longer being used for the purposes of the withdrawal which could be used for mineral development or other purposes.

g. Give priority to meeting the material needs of local governments and agencies.

h. Limit the sale of mineral materials if they are readily available from commercial suppliers to minimize competition with suppliers.

i. Compare the public value of leasing minerals with the use of lands for other purposes, and compare the value of other resources which might be lost to the mineral values foregone.

j. The coal unsuitability criteria have already been applied to all areas within the Piceance Basin Planning Area with potential for coal development.

k. Consolidated access routes and rights-of-way for oil and gas and other mineral development, and criteria for locating them will be considered.

l. Full consideration will be given to the Bureau's Mineral Resources Policy.

Agricultural Lands

1. *What will be the direct and indirect impacts of energy development on agricultural lands (irrigated and nonirrigated crop lands) and how will they be analyzed and mitigated?*

a. Identify acreage involved, longevity of disturbance, and production declines of agricultural lands disturbed.

b. Determine post-reclamation land use objectives for disturbed lands with view to replacing lost agriculture acreage.

c. Coordinate with city and county governments to achieve local planning objectives.

d. Identify indirect impacts of potential agricultural land conversion.

Soils

1. *What mitigating measures should be taken to reclaim areas of surface disturbance caused by development to stabilize and protect the soil?*

a. Classify soil types according to reclamation potential and establish standard mitigation guidelines.

b. Develop a monitoring program to evaluate results of soil mitigation activities.

c. Develop a management process to facilitate reclamation of disturbed sites.

2. *Should an active soil management program be established to reduce the current rate of active soil erosion?*

a. Apply management techniques including a monitoring system to identify, control, and improve soil resistance to erosion especially in crucial areas.

Hydrology

1. *Will the effects of water resource use in the basin be detrimental to the quantity and quality of those waters? To what extent will the regional hy-*

drologic system be altered by development? What mitigation measures will be necessary?

a. Classify the waters in the resource area according to their quality.

b. Develop management practices which will protect and maintain existing water quality and quantity.

c. Identify methods to improve the quality of waters, especially those not meeting minimum legal standards.

d. Require that all waters (surface and ground) associated with development activities be treated according to state and Federal regulations prior to discharge.

e. Ensure through mitigation that uses of water for mineral development and other purposes will not have any long-term detrimental effects on the hydrologic system of Piceance Basin.

Water Rights

1. *What are the current water rights and allocation in the Piceance Basin and how will these be affected by management objectives and development?*

a. Inventory current allocated water uses (rights) to determine the minimum quantity of water available for public use.

b. Determine the minimum amount of water necessary for the anticipated population growth that would occur from the highest possible level of oil shale and other development.

c. Define BLM's authority and jurisdiction in water rights.

Range

1. *What projects and practices are necessary to accomplish rangeland objectives?*

a. Determine impacts to the current range management program from decisions made in the RMP.

b. Identify changes or additional projects and rangeland management practices necessary to achieve range management objectives.

Fire

1. *What are the desired objectives of a fire management plan and how should they be achieved?*

a. Classify lands according to their suitability for various intensities of fire suppression activities.

b. Identify the role of wildfire as a tool in multiple-use resource management.

c. Develop management objectives and guidelines for fire suppression activities.

Forestry

1. *What will be the impacts to the forest resource from energy development and pinyon-juniper manipulation projects?*

a. Determine the effect to the forest resources from energy development, habitat improvement projects, and a fire management program.

b. Integrate forest management objectives with energy development plans in areas of high potential for conflict.

2. *What factors should be considered to properly manage the forest resources?*

a. Classify lands according to their potential for forest product growth and harvest.

b. Compare the value of forest resources against other resource values such as range, wildlife, and mining.

c. Determine the demand for forest products based on market conditions.

d. Develop efficient plans for the harvest, long-term management and protection of forest products.

Threatened, Endangered, Rare and Sensitive Plants, and Remnant Vegetation Associations

1. *How should threatened, endangered, rare or sensitive plant species and endemic vegetation communities be managed?*

a. Classify areas of rare or sensitive plant species and endemic vegetation communities and determine management of these sites.

b. Identify and protect any threatened or endangered plant habitats.

Wild Horses

1. *How will wild horse management and implementation of the Piceance Basin Herd Management Area Plan be affected by energy development?*

a. Determine impacts to the wild horse Herd Management Area Plan from decisions made in the RMP.

Wildlife

1. *What wildlife habitat components and management attributes are necessary for consideration to achieve wildlife population and habitat condition objectives?*

a. Classify and rank lands according to their resource value to wildlife.

b. Develop effective management practices and monitoring programs in energy development areas through consultation with the Colorado Division of Wildlife and the U.S. Fish and Wildlife Service.

c. Determine the effect on implementation of the Piceance Basin Habitat Management Plan from decisions made in this RMP.

2. *What impacts to the wildlife resource should be considered important and how should they be mitigated?*

a. Evaluate current mitigation of development impacts and success of recent reclamation efforts on wildlife and determine if new technology and changes are necessary.

b. Determine areas of conflict between wildlife and other land uses.

c. Identify important wildlife habitat areas; including threatened and endangered species habitat, where human encroachment and other impacts require specific management or mitigation.

Cultural Resources

1. *How will the BLM ensure adequate protection and proper management of cultural resources on public land?*

a. Locate cultural resources by conducting appropriate literature searches and inventories.

b. Protect or avoid sites of importance.

c. Enhance and interpret sites of important scientific or educational value for the public.

Paleontology

1. *How will the BLM ensure adequate protection and proper management of paleontological resources on public land?*

a. Identify geologic formations which have potential for containing significant paleontological resources.

b. Protect significant paleontological resources, if possible.

c. Provide interpretation and enhancement of paleontological sites of significant scientific or educational value.

Visual Resources

1. *Can oil shale development be accommodated within existing visual management classes? If not, can impacts be mitigated to allowable levels or are interim non-conformance designations needed?*

a. Follow visual resource management class guidelines when planning multiple use activity locations for public lands.

b. Reduce visual impacts to activities by evaluating landscape character and repeating landscape elements to fit projects into the landscape or to relocate projects to a different landscape type or position to reduce the contrast and disturbance that will be created.

Off-Road Vehicles

1. *What public lands should be designated as open, closed or limited for off road vehicle use? In the limited category, what types of restrictions should be considered?*

a. Identify areas that are suitable for open, closed, or restricted ORV use.

b. Limit or restrict ORV use in environmentally sensitive areas where it is a management concern.

c. Ensure ORV designation and management are consistent with Colorado off-road recreational vehicle statutes.

Recreation

1. *What type of recreation opportunities, including developed sites, should be provided in the Piceance Basin and where should they be located?*

a. Identify dispersed recreational opportunities in the Piceance Basin Planning Area.

b. Identify areas suitable for recreation development, especially undeveloped areas already being heavily used, areas adjacent to existing travel corridors, and areas that will serve the needs of visitors from throughout the state and nation.

c. Limit recreation development actions to areas which can sustain recreational use without environmental damage and which can realistically be efficiently developed and managed. Ensure these areas are necessary to provide recreation sought by the public and that this recreation is not readily available elsewhere.

d. Limit development to activities which do not duplicate existing services or opportunities and which do not generally have a profit potential for the private sector.

e. Emphasize interpretive programs and resource use programs other than facility use programs.

f. Encourage state, local, private and other Federal agencies to provide recreational developments through easements or outright land acquisition.

g. Make some access to natural and recreational areas available when such access is sought by the public.

2. *What impacts will expanded oil shale development have on existing recreation opportunities? How can they be mitigated?*

a. Identify areas being impacted.

b. Protect areas by providing intensive site management where necessary and regulating use if nonregulatory measures fail.

c. Favor management, design, education and cooperation over direct regulatory measures to protect resources.

Wilderness

1. *What impacts, especially on air quality, will additional oil shale development have on wilderness areas, National Parks and Monuments, and other sensitive areas in the region?*

a. Require monitoring of Air Quality Related Values (AQRVs) in areas of intensive use and wilderness areas.

b. Ensure that BLM activities comply with all state and Federal standards and regulations.

c. Assure that management practices do not adversely affect air quality standards for wilderness.

d. Identify the potential impacts from increased visitor use to Wilderness and National Parks in the region resulting from increased population.

e. No BLM Wilderness Study Areas exist in the planning area.

Social/Economics

1. *How will the local communities and citizens be impacted by BLM's decisions in the RMP?*

a. Analyze the local economy and the extent to which it is dependent on products, services or uses of BLM lands.

b. Determine which actions could have primary or secondary social or economic impacts on the surrounding areas.

c. Evaluate carrying capacities of community and social services infrastructures.

d. Assess community attitudes and social traditions that are likely to be impacted.

e. Determine role, if any, of the Cumulative Impacts Task Force in assessing socioeconomic impacts.

2. *How can the social and economic impacts identified in the RMP best be mitigated?*

a. Define the BLM's authority to require the lessee to provide various levels of socioeconomic mitigation.

b. Assess which socioeconomic stipulations are the responsibility of the BLM and which should be required by local or state government.

c. Determine what types of mitigating measures would best ameliorate anticipated impacts which result from decisions made in the RMP.

Transportation

1. *What will be the impacts to existing transportation systems and how can they be mitigated? What*

is the potential to improve transportation systems within the Piceance Basin?

a. Classify the value of roads according to type and level of use.

b. Identify road and trail maintenance responsibilities.

c. Close and rehabilitate unneeded roads for resource protection and public safety.

d. Assure the maintenance and improvement of roads to meet their use classification.

e. Identify proposed roads needed for management of lands.

Noise

1. *What will be the increase in noise levels due to anticipated development and ancillary transportation activities and how can they be mitigated?*

a. Identify existing noise levels in Piceance Basin and their sources.

b. Assure mitigation of potential development which would cause noise levels to elevate above acceptable tolerance levels to humans and animals.

Energy

1. *What are the energy requirements for developing oil shale and other minerals and secondary demands? What will the sources for this energy be?*

a. Predict the possible levels of energy demand vs. output, for various levels of mineral development in Piceance Basin.

b. Evaluate the effectiveness of energy to meet industrial and increased population needs.

c. Develop mitigation to compensate for the increased energy demand in the region.

d. Evaluate the use of various energy resources to supply the energy needed for mineral development.

Lands

1. *How will BLM manage the public lands for disposal and exchange?*

a. Identify lands which are difficult or uneconomic to manage or which will most prudently serve important public objectives by their disposal or sale.

b. Identify lands which could be exchanged to best serve the public interest.

c. Identify lands which could be transferred to other agencies for more efficient or appropriate management.

d. Identify private lands which, if acquired, would consolidate the public lands and thereby improve their management.

e. Determine areas of split mineral ownerships where management conflicts exist.

f. Identify areas with significant oil shale or coal resources which can be consolidated by exchange of Federal and state mineral rights.

g. Identify lands with no mineral potential where mineral rights could be sold to a private surface owner, especially where industrial, residential, commercial or recreational developments exist or are proposed.

h. Identify mineral estates which cannot be sold because they contain valuable mineral deposits.

i. Establish interim management for lands identified by the state for their indemnity selection.

2. *How will the RMP affect future rights-of-way and utility corridors?*

a. Identify tracts or corridors of public lands which, if used as a right-of-way, would have greater public value than if used for other purposes.

b. Identify existing major tracts or corridors of public land that would delineate a rights-of-way corridor.

c. Identify existing and future corridor proposals by Federal, State, industrial and public utilities for routing through Piceance Basin.

d. Limit the granting of rights-of-way in unsuitable areas, such as floodplains, geologic hazard areas, wilderness study areas, critical wildlife habitat, etc.

Surface Reclamation

1. *What level of reclamation is adequate based upon Federal and State requirements?*

a. Ensure that reclamation returns the land to pre-disturbance or other desirable land use objectives for long-term sustained use.

b. Ensure that reclamation achieves Federal and State requirements.

c. Ensure that reclamation practices are flexible enough to accommodate situations of temporary disturbances.

d. Identify long-term reclamation problems so mitigation can be designed to ensure long-term success.

e. Identify responsibilities for reclamation in the event of a premature, unanticipated shut-down.

Relationship to Other Documents and Decisions

1. White River Resource Area Management Framework Plan--A Management Framework Plan (MFP) for the entire White River Resource Area has been in effect (with several amendments and updates) since 1975. It was updated comprehensively in 1980, but has subsequently been amended twice (for coal and wilderness). The MFP provides for future oil shale leasing by identifying and prioritizing eight tracts for future leasing, however, no cumulative environmental analysis was performed on this proposal. Rather than amend the MFP for oil shale, it was determined that a comprehensive Resource Management Plan should be prepared, due to the potential environmental impacts of such a leasing program, and the interrelationship of oil shale development with other resource values present in the basin.

The decisions in the MFP have been carried forward in the Resource Management Plan where applicable. These are reflected in the Current Management Alternative in the Resource Management Plan itself. The decisions in this RMP will supercede the MFP for the Piceance Basin Planning Area when the RMP is approved.

2. Grazing Management Program--In 1980, a rangeland management program and environmental impact statement was completed, directing BLM's range program for the White River Resource Area. This statement identified the overall management of the grazing lands in the Piceance Basin, and directed the preparation of Allotment Management Plans to implement those decisions. The decisions and projected implementation relevant to the Piceance Basin Planning Area has also been incorporated into the Resource Management Plan as appropriate. Alternative management decisions for range have not been developed, but the impacts of the resource management alternatives on the range program have been analyzed.

3. Wilderness EIS--The White River Resource Area has completed an environmental impact statement on wilderness management in the resource area. None of the Wilderness Study Areas identified in the inventory phase were located in the Piceance Basin Planning Area. As with range, management alternatives for wilderness were not developed in the Resource Management Plan, however the impacts of the Resource Management Plan alternatives on recommended and designated wilderness areas in the region will be analyzed.

4. Coal Amendment--The White River Management Framework Plan was amended in 1981 to examine lands within the Resource Area which had high to moderate potential for coal mining. A determination was made on the suitability of these areas for further consideration for coal development. Approximately 47 square mile of lands within the Piceance Basin Planning Area east of Rangely were identified as suitable for further consideration for the development of coal in the plan amendment. These lands were reexamined for the applicability of the original suitability determinations, and how they would change due to the revised coal regulations issued in July 1982. We found no significant changes due to the reapplication of the revised unsuitability criteria. In order to comply with the revised regulations, a call for coal resource information was issued in May 1983 without response.

The decisions made in the 1981 amendment have been carried though in this RMP, with some modification in the multiple land use decisions as appropriate for the different alternatives in response to the objectives of each alternative.

These lands are within the Green River-Hams Fork Coal Region. An environmental impact statement is currently underway that is analyzing several potential coal lease tracts within the region on a site-specific basis. None of the tracts being examined in the current EIS are located within the Piceance Basin Planning Area. However, those lands identified as suitable for coal development in the coal amendment may be considered in future site-specific EISs. The coal amendment is fully incorporated by reference.

5. Programmatic Oil Shale Environmental Impact Statement--A program for long-term, commercial Federal oil shale leasing is being developed and is being analyzed in a "programmatic" EIS. Alternative methods of incorporating the leasing program into the land use planning process are being considered, and the cumulative impacts of the program to Colorado, Utah and Wyoming are being evaluated. The decision on the method to be used will direct how the site-specific lease tract analysis for oil shale will be conducted, and where in the

planning process the analysis will occur. Rather than wait for completion of the programmatic EIS, however, it was determined that the planning process could proceed, regardless of the leasing method ultimately selected. It is currently anticipated that the process will be two tiered, in which the RMP establishes a framework within which future leasing can take place, followed by a subsequent tract delineation process with site-specific analysis and NEPA compliance. This RMP is designed to accommodate such a process.

6. Oil and Gas Leasing Umbrella Environmental Assessment--A comprehensive management program for oil and gas was established for the White River Resource Area in an "umbrella" environmental assessment. The current process of approving applications for permit to drill, rights-of-way, exploration and development of oil and gas was formalized and made consistent in an effort to minimize surface disturbing activities caused by increased leasing.

Stipulations were established for site-specific activity throughout the resource area. In addition, a five year plan for future development would be requested as a lease stipulation on future leases prior to any drilling activity. The purpose of this voluntary submission is to consolidate placement and construction of access roads and product transportation routes to minimize total disturbance in the resource area, while at the same time reducing construction and maintenance costs of these facilities for industry. These kinds of consolidated transportation routes, right-of-way corridors and criteria for location have been considered in the Resource Management Plan, as well as alternatives to such actions.

7. Joint Working Group Proposals on Oil Shale Leasing Legislation--A joint working group comprised of industry, environmental groups, state and local governments has proposed new legislation to be enacted by the U.S. Congress to change the way oil shale lands can be leased. Every attempt has been made in the RMP to accommodate these proposed changes, without compromising the management decisions made in the plan or challenging current laws. The future of this proposed legislation is uncertain.

Chapter II
Description of the Planning Area

CHAPTER II
DESCRIPTION OF THE PLANNING AREA

This chapter describes the physical environment of the planning area, and the social and economic conditions of the region. Emphasis is given to critical or limiting factors that would be affected by BLM management actions in the Piceance Basin.

The information in this chapter is summarized from more detailed data available in the White River Resource Area office. In most cases, references are cited where additional information may be obtained. For most resources, more detailed data is available in the Piceance Basin Planning Unit Resource Analysis of the existing Management Framework Plan for the White River Resource Area (USDI, BLM 1981). This data source has not always been referenced.

AIR QUALITY

Because air quality and climatic characteristics vary on a regional scale, the following analysis examines a larger area than just the Piceance Basin Planning Area. The existing air quality of the Piceance Basin is typical of undeveloped regions in the western United States; ambient pollutant levels are usually near or below the measurable limits. Notable exceptions in this region include high, short-term concentrations of total suspended particulates (TSP) (primarily wind blown dust), ozone (O_3) and carbon monoxide (CO), especially in nearby towns. Locations vulnerable to decreasing air quality from extensive energy-related resource development include the immediate operation areas (coal mines, shale oil retorts, etc.), local population centers with their induced impacts, and distant areas which can be affected through long-range transport of pollutants.

National and state ambient air quality standards limit the total amounts of specific pollutants CO, lead, nitrogen dioxide (NO_2), O_3, sulfur dioxide (SO_2) and TSP. These standards were established to protect public health (primary standards) and public welfare (secondary standards). Areas which consistantly violate maximum standards because of man-caused activities are classified as non-attainment areas, and must implement a plan to reduce ambient levels below the maximum pollution standards (Table II-1). To protect areas not classified as non-attainment, Congress established a system for the Prevention of Significant Deterioration (PSD) through the Clean Air Act Amendments of 1977.

TABLE II-1

STATE AND FEDERAL AIR QUALITY STANDARDS (MICROGRAMS PER CUBIC METER)

Pollutant	Averaging Time [a]	Ambient [b]				Increments [c]					
		Federal		Colorado		Federal			Colorado		
		Primary	Secondary	Primary	Secondary	Class I	Class II	Class III	Category I	Category II	Category III
Carbon monoxide	8-hour	10,00	10,000	10,000	--	--	--	--	--	--	--
	1-hour	40,000	40,000	40,000	--	--	--	--	--	--	--
Lead	Quarterly	1.5	1.5	--	--	--	--	--	--	--	--
Nitrogen Dioxide	Annually	100	100	100	--	--	--	--	--	--	--
Oxidants (Ozone)	1 hour	235	235	160 [d]	--	--	--	--	--	--	--
Sulfur Dioxide	Annual (Arith.)	80	--	--	--	2	20	40	2	10	15
	24-hour	365	--	--	--	5	91	182	5	50	100
	3-hour	--	1,300	700	--	25	512	700	25	300	700
Total Suspended Particulates.	Annual (Geom.)	75	60	75	60 [e]	5	19	37	--	--	--
	24-hour	260	150	260	150	10	37	75	--	--	--

Source: National Primary and Secondary Ambient Air Quality Standards (40 CFR 50 *et seq*, as amended January 5, 1983). Requirements for Preparation, Adoption and Submittal of Implementation Plans (40 CFR 51.24, as amended September 3, 1982). Approval and Promulgation of Implementation Plans (40 CFR 52.21, as amended June 25, 1982). Code of Colorado Regulations (Volume 5, Part 14 as amended May 27, 1980).

[a] Short-term standards (those other than Annual and Quarterly) are not to be exceeded more than once each year, except the federal ozone standards. Under federal regulations, the "expected number of days" with ozone levels above the standard is not to be exceeded more than once per calendar year.

[b] Ambient standards are the absolute maximum levels allowed to protect either public health (primary) or welfare (secondary).



Figure II-1. Northwest Colorado showing Location of Piceance Basin Planning Area, Wilderness Areas, National Monuments in the Region, and Communities that may be Affected.

[c] Incremental standards are the maximum incremental amounts of pollutants allowed above the baseline in regions of clear air.
[d] The State ozone standards of 160 ug/m³ was identical to the Federal standard when adopted in 1978. The State ceased applying the 160 ug/m³ standard when the Federal standard was revised to 0.12 ppm (235 ug/m³). Because the 0.12 ppm standard is not exceeded until 0.125 ppm is measured, the State now recognizes 245 ug/m³ as the equivalent standard. The Colorado Ambient Air Quality Standards have not been revised to reflect this change.
[e] The Colorado annual secondary TSP standard was established as a guide in assessing implementation plans to achieve the 24-hour standard.

Areas were classified by the additional amounts of TSP and SO_2 degradation which would be allowed. Class I areas, predominately National Parks and certain Wilderness Areas, have the greatest limitations; virtually any degradation would be significant. Areas where moderate, controlled growth can take place were designated as Class II. Class III areas are those areas which allow the greatest degree of impacts. Most of the study region is Class II and the Grand Junction area is a non-attainment area for TSP.

Class I areas closest to, and predominately downwind from the Piceance Basin are the Maroon Bells-Snowmass, Flat Tops and Mount Zirkel Wilderness Areas. Although they have Class II PSD status, other areas of special concern include Dinosaur and Colorado National Monuments and the Raggeds Wilderness Area. These areas are shown in Figure II-1. Arches and Canyonlands National Parks are also Class I areas, but their geographic and meteorologic relationships to the Piceance Basin Planning Area make them less susceptible to air quality degradation from development activity in the basin.

The State of Colorado has also established standards to limit additional air quality deterioration by establishing SO_2 increments in state designated Category I areas. The standard is identical to the Federal PSD Class I SO_2 increments and applicable to the Class I areas in Colorado listed above, plus Dinosaur and Colorado National Monuments.

Background concentrations of CO, lead, NO_2, O_3, SO_2 and TSP measured in the region are presented in Tables II-2 and II-3. Higher TSP levels would be expected near towns due to local combustion sources and traffic on unpaved roads, but the significant regional TSP concentrations are probably due to fugitive dust, primarily wind blown, which due to its greater mass settles relatively quickly. Since fugitive dust particulates are larger than those produced in combustion processes, they present a minimal inhalation health threat. The Environmental Protection Agency may alter the existing TSP regulations to reflect this difference by setting standards for particulates less than 10 to 15 microns in diameter, commonly called inhalable particulates and abbreviated PM_{10}.

TABLE II-2

SELECTED AMBIENT GASEOUS POLLUTANT CONCENTRATION DATA (MICROGRAMS PER CUBIC METER)

Station	Period	Carbon Monoxide				Nitrogen Dioxide		Ozone			Sulfur Dioxide			
		Ave. Time	Ann. Mean	1st Max.	2nd Max.	Ann. Mean	Max.	Ann. Mean	1st 1 hour Max.	2nd 1 hour Max.	Avg. Time	Ann. Mean	1st Max.	2nd Max.
Cathedral Bluffs [1]														
#020	1981	1	100	1,800	--	1.0	17	65	161	--	1	3.2	16	--
.....	1980	1	78	1,700	--	0.7	27	59	122	--	1	2.0	21	--
.....	1979	1	217	2,300	--	0.5	88	52	192	--	1	0.6	13	--
#023	1981	1	25	1,800	--	2.1	45	77	155	151	1	1.8	31	--
.....	1980	1	92	3,800	--	0.8	51	75	154	130	1	1.1	21	--
.....	1979	1	218	3,600	--	1.6	38	76	246	204	1	0.3	49	--
Chevron Tract [2]														
#E	10/80-9/81	1	115	5,405	--	3.8	66	69	149	--	1	2.6	21	--
Grand Junction, CO [3]														
.....	1982	1	--	13,800	12,650	.....	.....	.....	.....	.....	3	13.0	--	52
.....	.....	8	--	8,855	7,590	.....	.....	.....	.....	.....	24	--	--	26
.....	1981	1	--	18,400	14,375	.....	.....	.....	.....	.....	3	13	--	52
.....	.....	8	--	9,660	9,315	.....	.....	.....	.....	.....	24	--	--	21
.....	1980	1	--	16,100	13,225	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	8	--	7,015	7,015	.....	.....	.....	.....	.....	.....	.....	.....	.....
Naval Oil Shale Reserve [4]														
.....	6/81-9/81	.....	.....	.....	.....	.....	.....	--	265	--	3	--	118	--
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	24	--	69	--

TABLE II-2—Continued

SELECTED AMBIENT GASEOUS POLLUTANT CONCENTRATION DATA (MICROGRAMS PER CUBIC METER)

Station	Period	Carbon Monoxide				Nitrogen Dioxide		Ozone			Sulfur Dioxide			
		Ave. Time	Ann. Mean	1st Max.	2nd Max.	Ann. Mean	Max.	Ann. Mean	1st 1 hour Max.	2nd 1 hour Max.	Avg. Time	Ann. Mean	1st Max.	2nd Max.
.....	6/80-9/80	.....	.....	.....	.....	.....	.....	--	206	--	3	--	44	--
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	24	--	13	--
Rio Blanco Tract [5]														
#1	12/79-11/80	1	575	1,035	--	.....	.....	98	157	--	1	5.2	58	--
.....	12/78-11/79	1	575	1,725	--	.....	.....	98	157	--	1	26	26	--
.....	12/77-11/78	1	575	575	--	.....	8	176	--	1	26	79	--	
#3	12/79-11/80	1	575	575	--	.....	.....	78	137	--	1	7.9	34	--
.....	12/78-11/79	1	--	--	--	.....	.....	78	157	--	1	26	236	--
.....	12/77-11/78	1	--	--	--	.....	.....	78	137	--	1	26	288	--

Note: Underlined values indicate violation of Ambient Air Quality Standards.
[1] Source: Cathedral Bluffs Shale Oil Company 1982, 1981 and 1980.
[2] Source: Environmental Research & Technology, Inc. 1982.
[3] Source: Colorado Department of Health n.d.
[4] Source: TRW Energy Engineering Division 1981.
[5] Source: Gulf Oil Corporation 1981.

TABLE II-3

SELECTED PARTICULATE CONCENTRATION AND COMPOSITION DATA (MICROGRAMS PER CUBIC METER)

Station	Period	TSP				T_{15}			Sulfate			Nitrate			Lead		
		# Obs	Ann. Geo. Mean	1st 24 hr. Max	2nd 24 hr. Max.	# Obs	Ann. Geo. Mean	24 hr Max.	# Obs	Ann. Arth. Mean	24 hr. Max.	# Obs	Ann. Arth. Mean	24 hr. Max	# 1/4	Ann. Arth. Mean	1/4 Max.
Cathedral Bluffs [1]																	
Site 020	1981	--	14	69	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1980	--	10	--	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1979	--	16	63	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Site 023	1981	--	14	86	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1980	--	11	--	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1979	--	16	81	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Chevron [2]																	
Site A	10/80-9/81	--	11	227	224*	--	4	--	.....	.....	.....	.....	.....	.....	.....	.....	.....
Site E	10/80-9/81	--	21	--	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Colorado National Monument [11]																	
.....	1980	78	16	42	37	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1979	86	15	67	62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1978	54	(15)	39	33	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Craig Courthouse																	
.....	1982	79	62*	--	160	.....	.....	.....	78	4.2	8.4	66	(1.2)	3.4			
.....	1981	83	87*	--	230*	.....	.....	.....	--	--	--	--	--	--	.....	.....	.....
.....	1980 [3,4,5]	71	86*	382	238*	.....	.....	.....	69	5.9	11.2	69	1.7	5.9	.....	.....	.....
.....	1979	41	93*	206	170*	.....	.....	.....	24	3.5	5.6	24	1.1	1.6	.....	.....	.....
Glenwood Springs Courthouse [34]																	
.....	1982	84	63*	--	271	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1981	83	63*	--	198*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE II-3—Continued

SELECTED PARTICULATE CONCENTRATION AND COMPOSITION DATA (MICROGRAMS PER CUBIC METER)

Station	Period	TSP # Obs	TSP Ann. Geo. Mean	TSP 1st 24 hr. Max	TSP 2nd 24 hr. Max.	T_{15} # Obs	T_{15} Ann. Geo. Mean	T_{15} 24 hr Max.	Sulfate # Obs	Sulfate Ann. Arth. Mean	Sulfate 24 hr. Max.	Nitrate # Obs	Nitrate Ann. Arth. Mean	Nitrate 24 hr. Max	Lead # 1/4	Lead Ann. Arth. Mean	Lead 1/4 Max.
.....	1980	88	68*	203	199*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1979	85	57	188	173*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Grand Junction Rood St. [3]																	
.....	1982	76	73*	--	196*	76	59	175	71	4.6	20.9	69	2.4	17.3	4	.68	1.0
.....	1981	84	77*	--	232*	65	57	194	.....	.....	.....	.....	.....	.....	4	.70	1.0
.....	1980	72	78*	--	144	.....	.....	.....	72	4.8	9.8	72	2.1	8.4	4	.75	1.0
.....	1979	83	82*	183	176*	.....	.....	.....	64	4.4	12.6	64	3.8	30.7	4	1.0	1.5
Grand Valley High School [3,5]																	
.....	1982	34	(77)	--	254*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1978	51	(55)	213	208*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1977	35	(52)	334	217*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1976	78	71*	361	342*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Meeker Courthouse																	
.....	1982	82	55	--	225	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1981	77	59	--	134	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1980 [3,4,6]	70	66*	212	171*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1979	--	--	--	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Naval Oil Shale Reserve [7]																	
.....	6/81-9/81	14	(24)	37	--	14	(14)	29	.....	.....	.....	.....	.....	.....	--	.01	--
.....	6/80-9/80	--	--	30	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	--	.01	--
Rangely High School [3]																	
.....	1982	77	648	--	299*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1981	66	(68)	--	172*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1980	20	(60)	--	132	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Rifle, Third Ave [3]																	
.....	1982 [3]	77	43	--	141	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1981 [12]	80	99*	--	411*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1980 [4,5]	69	156*	510	479*	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	--	0.5
.....	1979	83	128*	694	660*	.....	.....	.....	66	3.6	12.2	66	1.8	10.6	4	.72	1.2
Rio Blanco Tract [8]																	
Site 1	12/79-11/80	--	13	61	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	12/78-11/79	--	11	303	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	12/77-11/78	--	14	59	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	2/75-1/77	--	9	211	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Site 3	12/79-11/80	--	18	96	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	12/78-11/79	--	21	192	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	12/77-11/78	--	26	160	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	2/75-1/77	--	15	281	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Rio Blanco [5]																	
.....	1975	--	13	111	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1973	--	14	144	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Steamboat Springs, Sixth St. [3]																	
.....	1982 [12]	77	77	--	280*	.....	.....	.....	76	5.4	11.3	54	(1.6)	7.3	3	--	0.3
.....	1981	32	(155)	--	549*	.....	.....	.....	--	--	--	--	--	--	2	--	0.4
.....	1980	68	134*	--	433*	.....	.....	.....	64	6.3	16.4	64	2.0	7.6	4	.38	0.5
.....	1979	62	(118*)	518	450*	.....	.....	.....	51	4.0	10.9	51	1.9	6.7	3	--	1.3

TABLE II-3—Continued

SELECTED PARTICULATE CONCENTRATION AND COMPOSITION DATA (MICROGRAMS PER CUBIC METER)

Station	Period	TSP				T_{15}			Sulfate			Nitrate			Lead		
		# Obs	Ann. Geo. Mean	1st 24 hr. Max	2nd 24 hr. Max.	# Obs	Ann. Geo. Mean	24 hr Max.	# Obs	Ann. Arth. Mean	24 hr. Max.	# Obs	Ann. Arth. Mean	24 hr. Max	# 1/ 4	Ann. Arth. Mean	1/4 Max.
Superior Tract [9]	12/76-11/77	--	40	647	--	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.3 [10]	.....

Note: Asterisk values indicate violation of Ambient Air Quality Standards, parentheses indicate insufficient data to determine reliable average.

[1] Cathedral Bluffs Shale Oil Company 1982, 1981 and 1980.
[2] Environmental Research & Technology, Inc. 1982.
[3] Colorado Department of Health n.d.
[4] Systems Applications Inc 1982.
[5] Woodward-Clyde Consultants 1981.
[6] Engineering-Science, Inc 1974.
[7] TRW Energy Engineering Division 1981.
[8] Gulf Oil Corporation 1981.
[9] USDI, Bureau of Land Management 1979.
[10] Concentration based on single sample.
[11] Lundy 1982.
[2] New monitoring location in 1982.

Ozone levels in the Rocky Mountain west are relatively high but of unknown origin. Elevated concentrations may be a result of long range transport from urban areas, subsidence of stratospheric ozone, or due to photochemical reactions with natural hydrocarbons. The true reason for elevated ozone values is uncertain, however. In addition to ozone, occasional peak concentrations of CO and SO_2 occur in the region, and may be attributed to combustion equipment near monitors.

Class I PSD regulations also address the potential for impacts to Air Quality Related Values (AQRV). These AQRVs include visibility, odors, and impacts to flora, fauna, soils, water, geologic and cultural structures. A possible source of impact to AQRVs is acid deposition. Tables II-4 and II-5 summarize the existing levels of visibility and acid deposition of the study region.

TABLE II-4

SELECTED VISUAL RANGE DATA (Km) [5]

Station	C-a/C-b Photographic [1]	Chevron Nephelometer [2]	Chevron Radiometer [2]	Colorado N.M. Radiometer [3]	Dinosaur N.M. Radiometer [3]	Craig, CO Radiometer [3]
Spring 1975-76	—/111/—	.....	.....	.....	.....	.....
Fall 1975-76	—/147/—	.....	.....	.....	.....	.....
Spring 1978	—/127/—	.....	.....	.....	.....	.....
Fall 1978	—/129/—	.....	.....	.....	.....	.....
Spring 1979	—/124/—	.....	.....	.....	.....	99/128/167
Summer 1979	.....	.....	.....	.....	146/179/242	98/131/174
Fall 1979	—/135/—	.....	.....	.....	153/192/274	88/124/174
Winter 1980	.....	.....	.....	.....	[4]	84/99/116
Spring 1980	—/126/—	.....	.....	[5]	[4]	86/133/205
Summer 1980	.....	.....	.....	130/176/238	95/150/238	104/139/185
Fall 1980	—/150/—	.....	.....	145/197/267	146/203/283	93/146/230
Winter 1981	.....	—/344/—	—/180/—	145/215/317	[4]	109/178/288
Spring 1981	—/135/—	—/200/—	—/210/—	[4]	[4]	109/172/272
Summer 1981	.....	—/250/—	—/170/—	120/166/229	95/135/192	101/147/214
Fall 1981	—/140/—	—/200/—	—/195/—	[4]	.....	99/158/252
Winter 1982	.....	.....	.....	.....	.....	77/127/207
Spring 1982	.....	.....	.....	.....	.....	115/175/268
Summer 1982	.....	.....	.....	.....	.....	110/160/234
Fall 1982	.....	.....	.....	.....	.....	114/168/247

TABLE II-4—Continued

SELECTED VISUAL RANGE DATA (Km) [5]

Station	C-a/C-b Photographic [1]	Chevron Nephelometer [2]	Chevron Radiometer [2]	Colorado N.M. Radiometer [3]	Dinosaur N.M. Radiometer [3]	Craig, CO Radiometer [3]
Winter 1983						95/156/254
Spring 1983						95/158/262
Summer 1983						12/156/226

[1] Source: Gulf 1981 and Stevens 1982. Measurements taken during intensive studies each spring and fall at an elevation of nearly 2100 m. Average of several targets.

[2] Source: Vertstuyft 1982. Radiometer Measurements taken of Flat Tops Wilderness; nephelometer at an elevation of nearly 2600 m. Data is averaged quarterly (i.e., winter is January through March, etc.)

[3] Air Resource Specialists, Inc. n.d. Measurements are taken daily of several targets and adjusted to a standard visual range elevation of 1550 m.

[4] Insufficient data.

[5] Data is presented as 10th/50th/90th percentile values.

TABLE II-5

SELECTED ACID DEPOSITION DATA (pH)

Season	Craig, CO				Douglas Pass				Grand Mesa				Marvine Ranch				Naval Oil Shale Res.			
	# Obs	Mean	1st Min	2nd Min	# Obs	Mean	1st Min	2nd Min	# Obs	Mean	1st Min	2nd Min	# Obs	Mean	1st Min	2nd Min	# Obs	Mean	1st Min	2nd Min
Spring 1979	2	5.21	5.00	5.63																
Summer 1979	7	4.89	4.48	4.65																
Fall 1979	10	4.79	4.23	4.65																
Winter 1980/81	15	5.10	4.74	4.81	4	5.92	5.50	6.09	12	5.21	4.52	5.00	16	5.25	4.60	4.72	2	5.72	5.64	5.81
Spring 1980/81	26	4.90	4.30	4.33	6	5.14	4.75	5.18	2	5.51	5.27	6.13	7	5.59	4.86	5.47	1	4.93	--	--
Summer 1980/81	21	4.88	4.32	4.45	4	4.63	4.41	4.50	1	5.26	--	--	7	4.81	4.49	4.74	3	5.15	5.03	5.05
Fall 1980/81	17	5.03	4.62	4.70	3	5.66	5.40	5.60	2	5.13	4.88	5.82	5	4.86	4.39	4.85	3	5.09	4.78	5.14
Winter 1982	6	5.43	5.04	5.20																

Sources: Natural Resources Ecology Laboratory n.d., and Turk 1982.
Note: The pH of natural rain water is approximately 5.6.

Visibility impacts can occur from atmospheric increases in small, light-scattering particles or increases in light absorbing gases (typically NO_2). Mechanisms of acid precipitation formation are currently under study. Preliminary results have correlated ambient sulfuric and nitric acids with combustion by-products (sulfates and nitrates).

In summary, annual average concentrations (micrograms per cubic meter) in rural regions of the study area range as follows: TSP:10 to 40, SO_2:0.3 to 3, and NO_2:2 to 30. Twenty-four hour average values range: 80 to 130 for TSP and 50 to 130 for SO_2. One hour average concentrations of ozone and CO range from 118 to 160 and 1000 to 2300, respectively. Average lead concentrations vary from 0.05 to 0.06 quarterly. Developed areas have nearly the same values with the following exceptions: average TSP concentrations range from 80 to 130 annually and 115 to 440 for 24 hours; NO_2 annual average concentrations range from 2 to 50; average one hour CO values may reach 20,700; and urban lead averages vary from 0.5 to 0.8 quarterly. Recent measured extremes appear in Tables II-2 and II-3.

CLIMATE

The Piceance Basin is located in a semi-arid, continental climate regime, characterized by dry air, sunny days, clear nights, little precipitation, extreme evaporation and large diurnal temperature changes. Because of the surrounding mountains, low pressure storm systems tend to pass around the region, whereas high pressure cells stagnate, blocked by the Rocky Mountains, resulting in moderate temperatures and abundant sunshine. The region's complex topography causes considerable variation in site-specific temperature, precipitation, and winds, but these influences are less on the plateaus than down in the valleys. Severe weather conditions such as tornadoes, floods, damaging hail, winds and thunderstorms are rare.

Temperatures vary mostly with elevation, and to a lesser extent, local microclimate. Generally, summer temperatures range from lows of 6°C (45°F) to highs of 30°C (85°F). Winter temperatures range from -15°C (5°F) to 2°C (35°F). Extreme temperatures may fall as low as -40°C (-

40°F) or up to 38°C (100°F). Frost-free periods vary from year to year and by location, but tend to range from 60 to 150 days.

Annual precipitation in the Piceance Basin is highly variable; ranging from 20 to 60 cm (8 to 24 inches), with slightly more than half of the moisture coming from scattered spring and late summer thundershowers. Snowfall amounts vary from 64 to 380 cm (25 to 150 inches); snowcover is commonly redistributed by wind. At lower elevations, limited data indicates that evaporation exceeds precipitation, with the driest conditions occurring in mid-summer.

Upper-level winds predominate from the southwest, but surface wind patterns are almost entirely dependent on local terrain and ground cover. Persistent winds with little directional modification are found on the plateaus, but winds in valleys show strong drainage influences (Figure II-2). Synoptic (pressure gradient) winds may be forced around hills or channeled through valleys, but if there are no strong gradient flows, diurnal upslope/downslope winds predominate.

Upslope winds usually occur on sunny mornings when the air at higher elevations heats rapidly and rises. Downslope winds occur when the air near the ground cools, becomes dense, and sinks downward along drainages. In the Piceance Basin, downslope winds are common and stronger than their upslope counterparts.

Air basins have been defined based on these drainage winds, indicating areas of similar atmospheric flow, topographic influence and general dispersion potential. Under stable conditions, pollutants tend to collect and concentrate in an air basin until regional synoptic winds disperse the air between basins. Generally, Piceance Creek downslope winds flow into the Craig Air Basin in the north and the Roan, or Parachute Creek, downslope winds flow south into the Colorado River Basin (PEDCO Environmental, Inc. 1981).

The extent that vertical and horizontal mixing will take place is related to the atmospheric stability and mixing height. Distributions of these factors from selected locations near the study area are presented in Tables II-6 and II-7. Unstable conditions occur under conditions of strong surface heating, typical of summer afternoons, producing upslope winds. Neutral conditions reflect a breezy, well-mixed atmosphere. Stable conditions are enhanced by rapid radiative cooling and downslope drainage, producing the least amount of dispersion. Inversions may exist under stable conditions, trapping pollutants within a certain layer of air. In the Piceance Basin, moderate inversions are formed during the summer in the evening and dissipate at dawn.

Winter inversions are stronger and last longer; an episode lasting three to six days may be expected (USDI, BLM 1976). Inversions are enhanced by weak pressure gradients, cold clear nights, snowcover and lower elevations.

TABLE II-6

FREQUENCY OF STABILITY CLASSES AT 500 METERS ABOVE GROUND LEVEL

Station	Season	Morning (percent)			Afternoon (percent)		
		Unstable	Neutral	Stable	Unstable	Neutral	Stable
Cathedral Bluffs Tract	Annual....	10	55	34	19	55	27
	Spring.....	11	61	28	34	54	12
	Summer .	13	51	36	45	32	23
	Fall	10	61	29	17	63	21
	Winter.....	2	48	50	6	69	25
Craig	Annual....	2	39	60	16	64	20
	Spring.....	5	56	39	31	54	14
	Summer .	0	21	80	14	66	20
	Fall	2	37	61	13	69	18
	Winter.....	0	43	57	6	65	29
Grand Junction	Annual....	2	52	46	1	84	15
	Spring.....	1	68	31	0	96	3
	Summer .	0	57	43	0	98	2
	Fall	1	49	50	0	91	9
	Winter.....	6	33	62	3	51	47

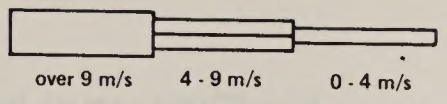
Source: Systems Applications, Inc. 1982. Percentages may not add to 100 percent due to rounding errors.

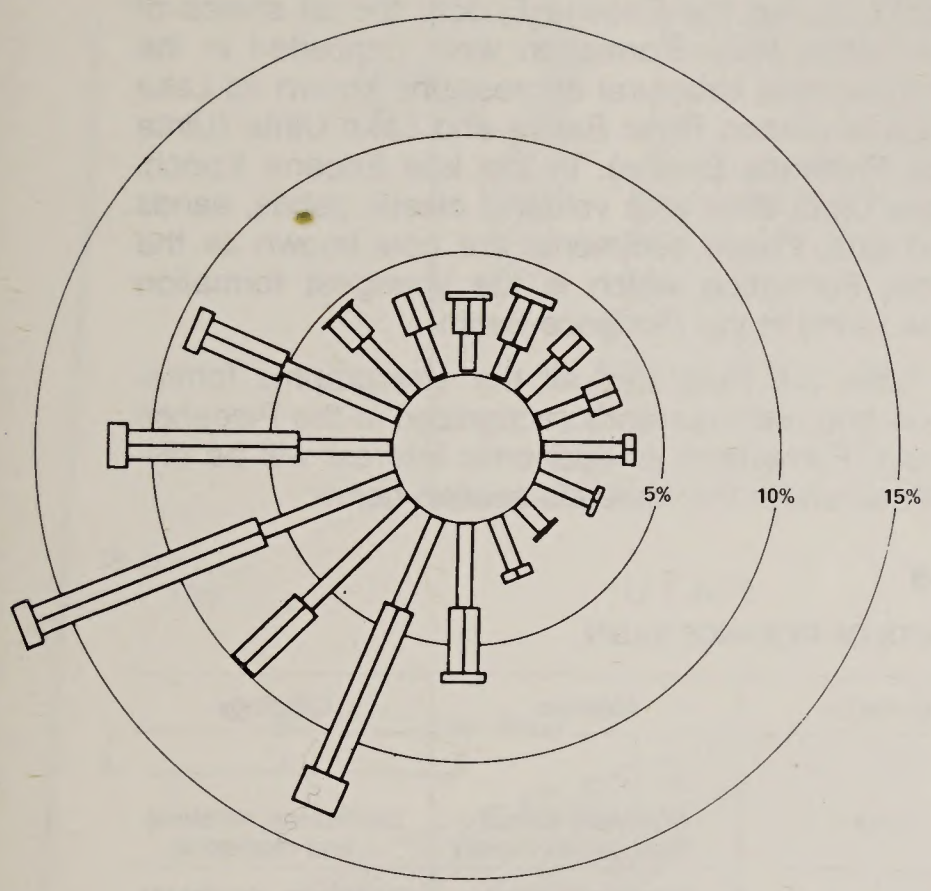
TABLE II-7

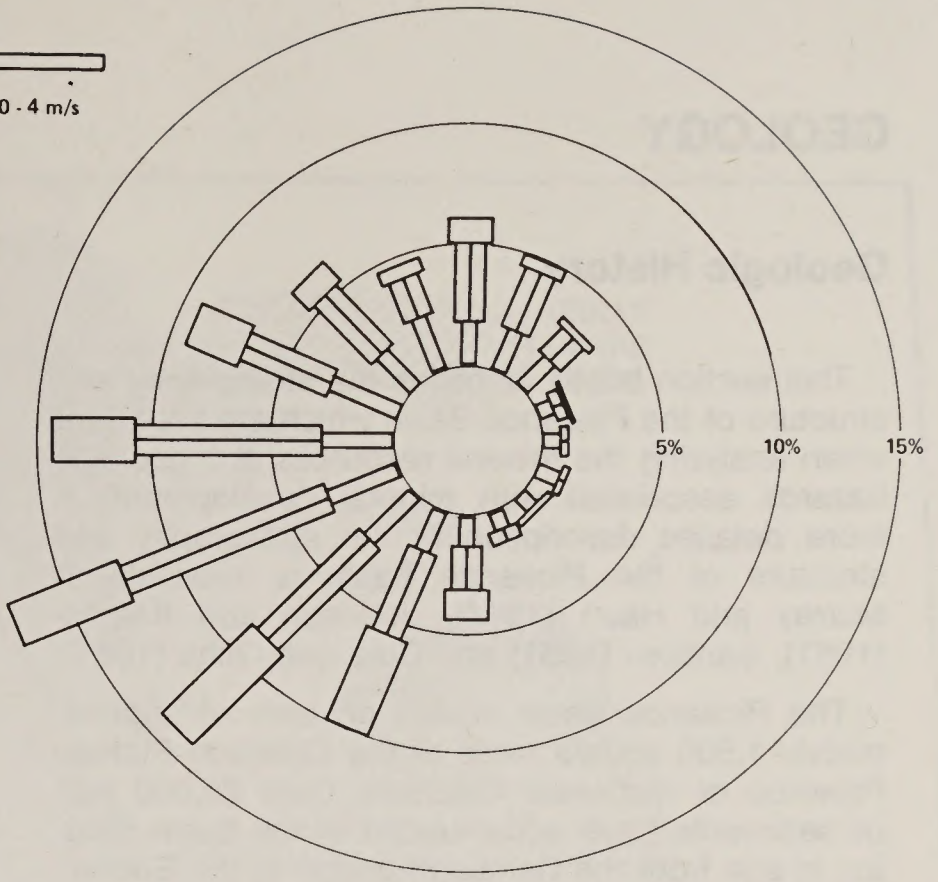
SELECTED MIXING LAYER HEIGHT DATA

Station	Season	Morning (Meters above ground level)	Afternoon (Meters above ground level)
Grand Junction [1]	Annual	384	2,600
	Spring	628	3,166
	Summer	307	3,940
	Fall	273	2,133
	Winter	329	1,160
Rio Blanco Tract [2]	Annual	450	--
	Spring	935	--
	Summer	179	--
	Fall	196	--
	Winter	290	850

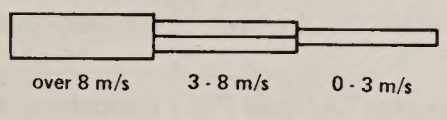
[1] Source: Systems Applications, Inc. 1982
[2] Source: Gulf Oil Corporation 1976



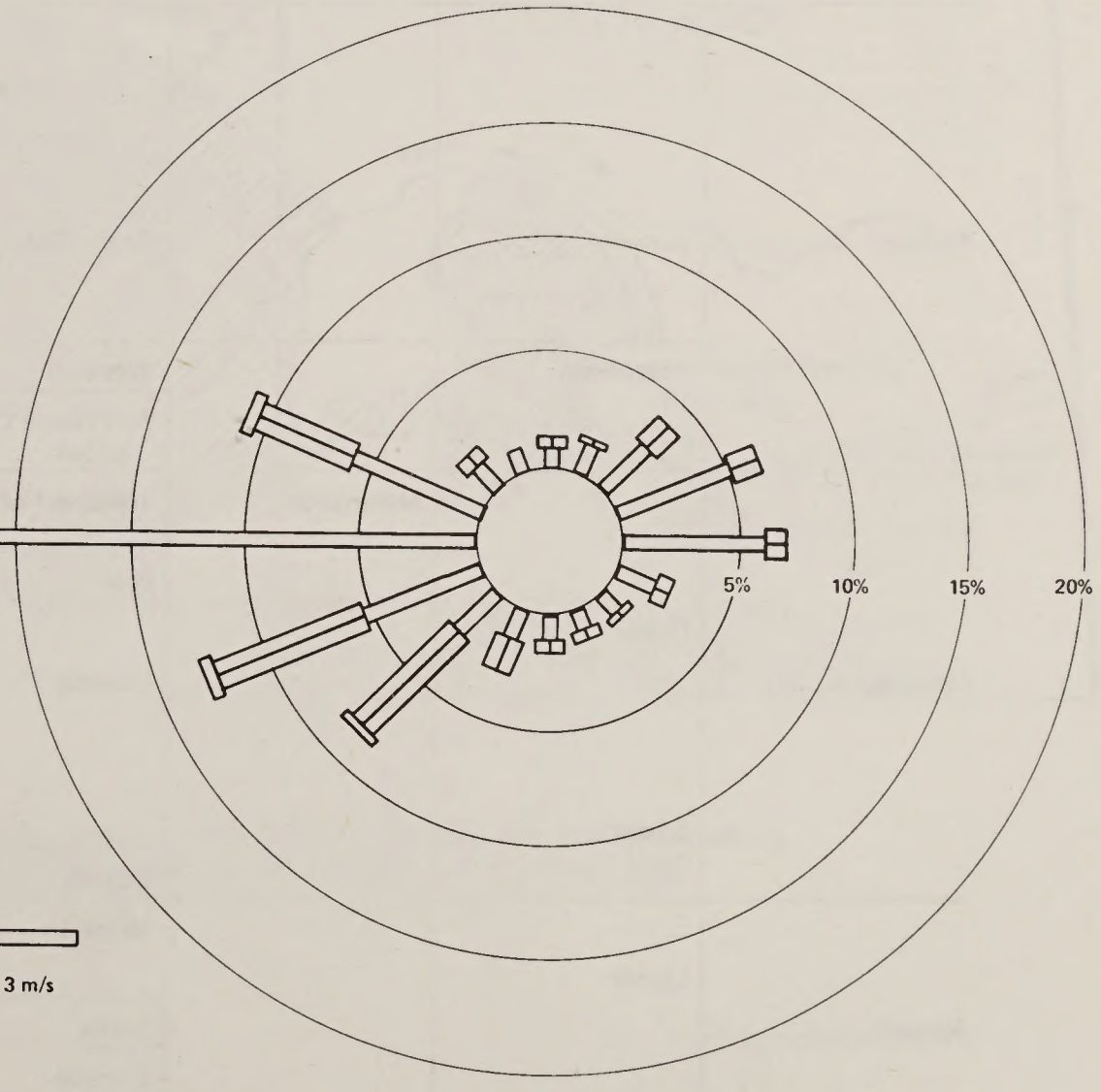


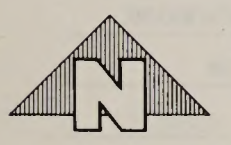


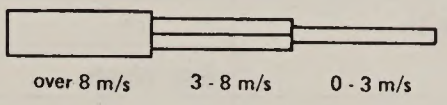
Wind Rose of Annual 700 millibar (mb) Winds at Grand Junction, Colorado (Engineering Science 1974)



Wind Rose of February 1975 to January 1976 Ten Meter Winds at C-a Site 1, Plateau (Gulf Oil Corporation 1976)







Wind Rose of February 1975 to January 1976 Ten Meter Winds at C-a Site 3, Valley (Gulf Oil Corporation 1976)

Figure II-2.

GEOLOGY

Geologic History

This section briefly identifies the stratigraphy and structure of the Piceance Basin which are important when analyzing the mineral resources and geologic hazards associated with mineral development. A more detailed description of the stratigraphy and structure of the Piceance Basin is available in Murray and Haun (1974), Johnson and Keighin (1981), Sanborn (1981) and Cole and Ochs (1981).

The Piceance Basin covers an area of approximately 1,500 square miles of the Colorado Plateau Province of northwest Colorado. Over 25,000 feet of sediments have accumulated in the basin ranging in age from the Cambrian period to the Eocene Epoch. It is part of a larger complex of Laramide Age (Cretaceous) basins including the Green River Basin in Wyoming and the Uinta Basin in Utah (Figure II-3).

At the end of the Cretaceous period and during the early Tertiary period (Paleocene and Eocene) various mountain building activities formed the structural features observed today in northwest Colorado. During the Eocene Epoch, the oil shales of the Green River Formation were deposited in the intermontane structural depressions known as Lake Gosiute (Green River Basin) and Lake Uinta (Uinta and Piceance Basins). In the late Eocene Epoch, Lake Uinta filled with volcanic clastic debris, sands and silts. These sediments are now known as the Uinta Formation which is the youngest formation now found in the Piceance Basin.

Table II-8 illustrates all the stratigraphic formations and units currently recognized in the Piceance Basin. Formations of economic interest will be discussed under the Minerals section below.

TABLE II-8

GENERALIZED STRATIGRAPHIC UNITS OF PICEANCE BASIN

System	Series	Group	Formation	Member	Lithology
Tertiary	Eocene		Uinta	(Formerly called Evacuation Creek)	Sandstone, siltstone and marlstone.
			Green River	Parachute Creek	Marlstone, sandstone and saline facies.
				Garden Gulch/Anvil Pts	Sandstone, siltstone
				Douglas Ck/Anvil Pts	Sandstone, siltstone
	Paleocene		Wasatch		Shale
			Fort Union Ohio Creek		Shale
Cretaceous.....	Upper	Mesaverde	Williams Fork		Sandstone, shale and coal.
			Iles	Sego	Sandstone
			Mancos	Buck Tongue	Shale
				Castlegate	Sandstone, shale
				Mancos	Shale Sandstone.
				Frontier	Sandstone
	Lower			Mowry	Shale
			Dakota		Sandstone
Jurassic	Upper		Morrison		Sandstone, Shale
				Salt Wash	Sandstone, Shale
			Curtis		Sandstone
			Entrada		Sandstone
	Middle		Glen Canyon	Formerly Navaho	Sandstone
	Upper		Chinle	Gartra	Red sandstone/shale

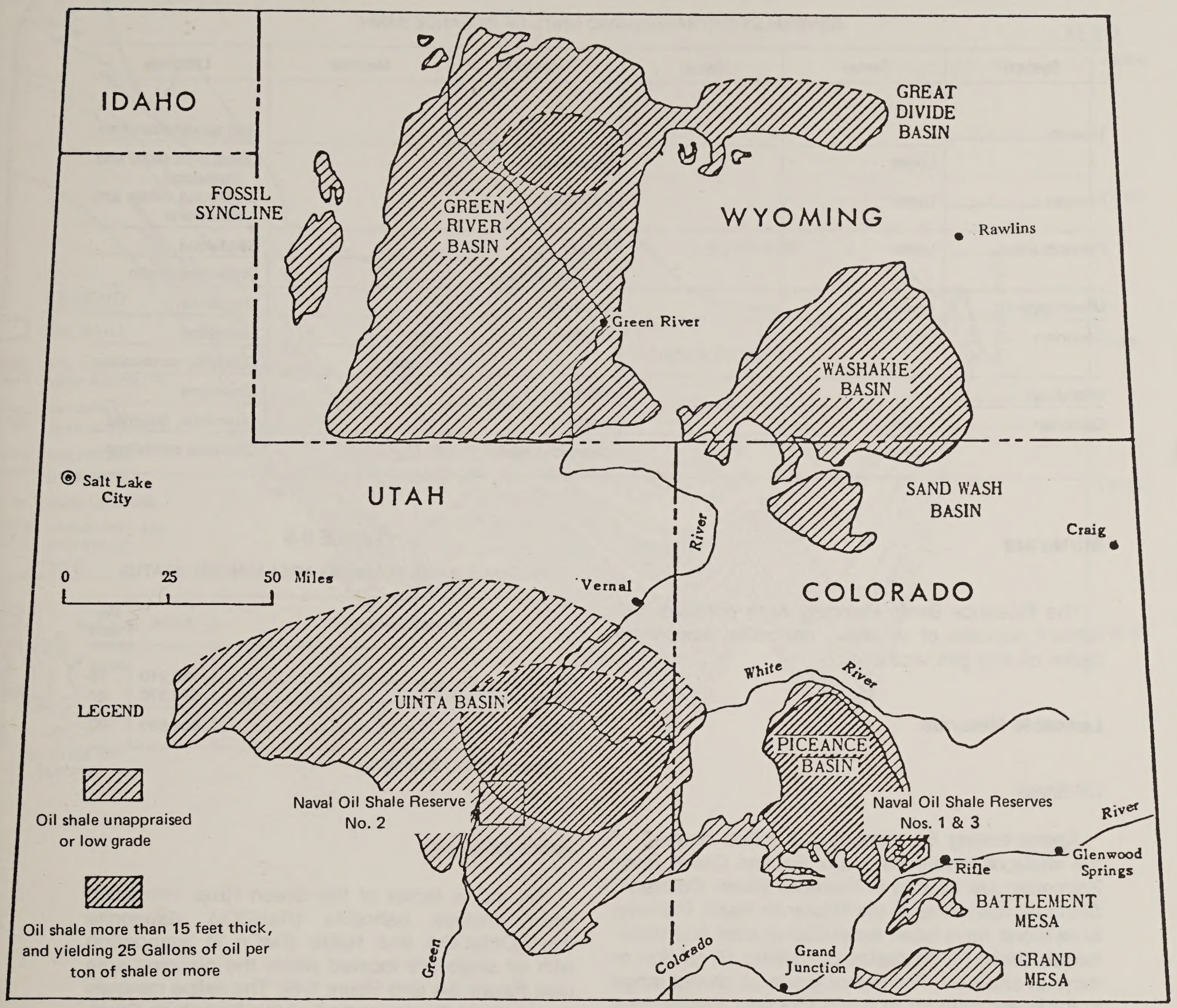


Figure II-3. Portions of the Cretaceous-Tertiary Basins of Northwest Colorado, Southwest Wyoming, and Northeast Utah, containing Low and High Grade Oil Shale (F.C.Jaffee 1962)

TABLE II-8—Continued

GENERALIZED STRATIGRAPHIC UNITS OF PICEANCE BASIN

System	Series	Group	Formation	Member	Lithology
Triassic					Red sandstone/shale
	Lower		Moenkopi		Calcareous shale and sandstone.
Permian	Upper		Park City		Sandstone, Shale and Limestone
Pennsylvanian	Lower		Weber		Sandstone
			Minturn-Morgan		Limestone, Shale
Mississippian	Lower		Leadville		Limestone.
Devonian	Upper		Chaffee	Dyer	Limestone.
				Parting	Quartzitic sandstone
Ordovician			Manitou		Limestone.
Cambrian	Upper		Dotsero		Limestone, dolomite.
	Lower		Sawatch-Lodore		Quartzitic sandstone.

Minerals

The Piceance Basin Planning Area contains significant deposits of oil shale, nahcolite, dawsonite, halite, oil and gas, and coal.

Leasable Minerals

Oil Shale

Approximately 80 percent (1.2 trillion barrels) of the shale oil resources of the Eocene Green River Formation are located in Piceance Basin, Colorado. Shale oil resources in the Piceance Basin Planning Area alone have been estimated at over 600 billion barrels (bbls) for oil shales containing 15 gal/ton or more of shale oil. The higher grade oil shales range in thickness from 10 to 2,000 feet with overburdens ranging from 0 to over 1,600 feet (Murray and Haun 1974). The thickest sections of oil shale and the thickest intervals of overburden occur in the deepest portion of the basin which is located approximately in the center of the planning area. Approximately 84 percent of the oil shale resources located in the planning area are managed by the Bureau of Land Management (Table II-9).

TABLE II-9

PICEANCE BASIN PLANNING AREA MINERAL STATUS

Mineral Ownership	Acres	Percent
Private	130,210	16
Public Land (BLM)	674,370	84
Total	804,580	100

(Source: USDI, BLM 1978).

Saline Minerals

The saline facies of the Green River Formation which include nahcolite ($NaHCO_3$), dawsonite ($NaAl(OH)_2CO_3$) and Halite (NaCl) in association with oil shale are located within the planning area (see Figure II-4 and Figure II-5). The saline minerals are found in the lower part of the Parachute Creek Member as crystalline aggregates and coarse-grained beds. These saline minerals are disseminated throughout the oil shale matrix.

An estimated 29 billion tons of nahcolite are located within the planning area (Beard et al 1974). Nahcolite could be used for various industrial uses; the most important being the removal of SO_2 from coal-fired power plant stack gases.

Approximately 19 billion tons of dawsonite have been estimated to occur in the Piceance Basin in association with nahcolite (Beard et al 1974). Dawsonite is a potential source of alumina.

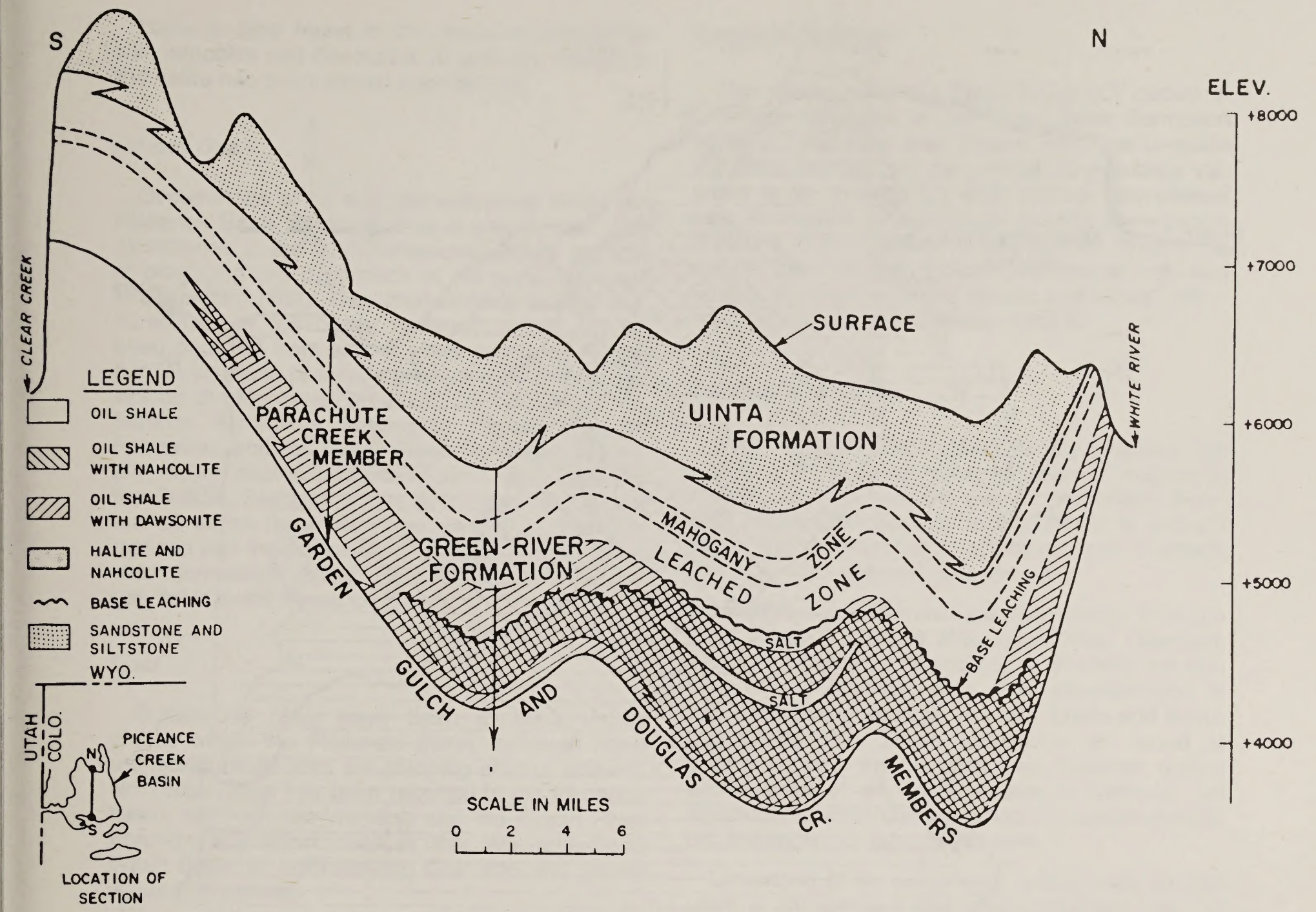
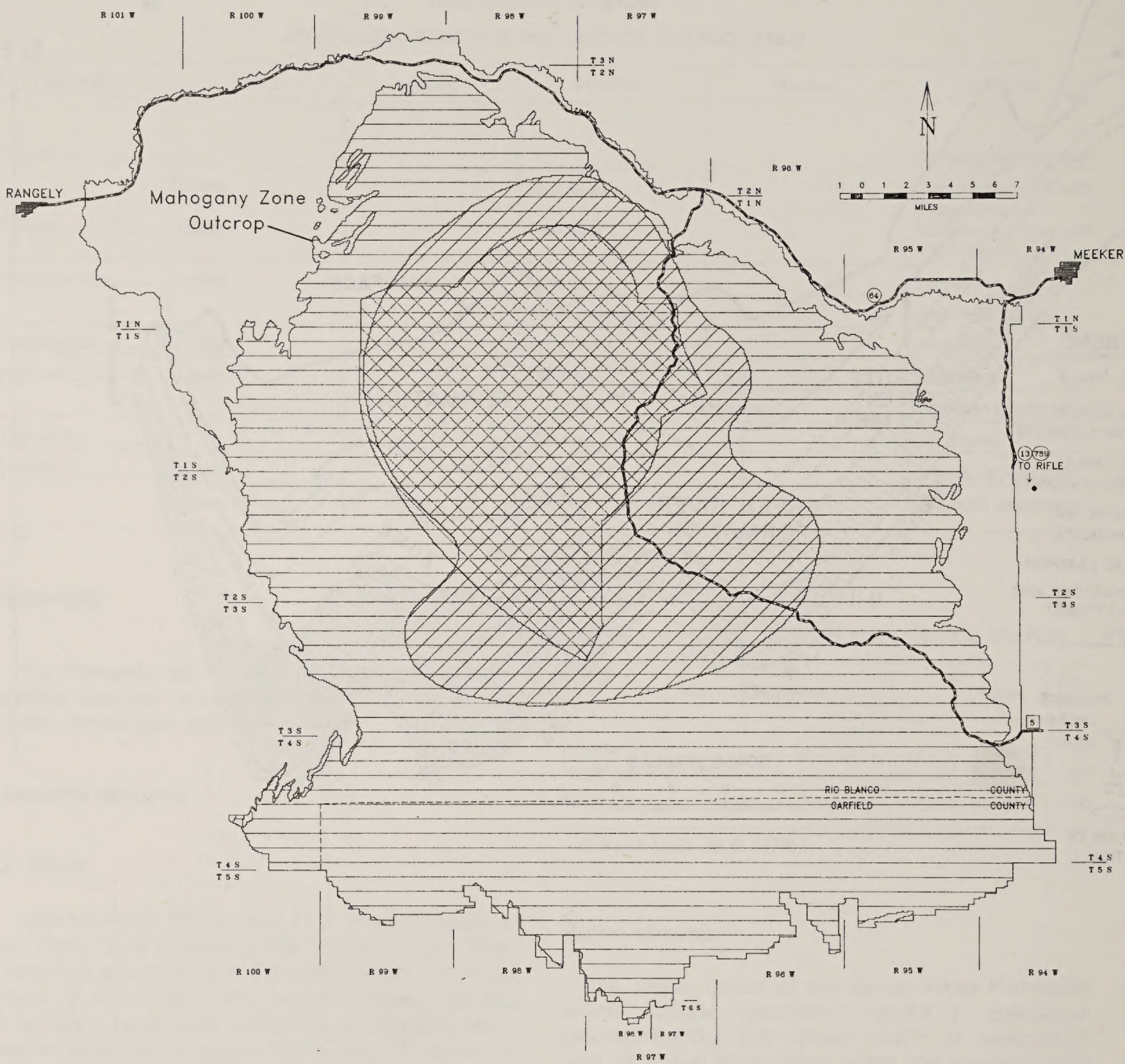


Figure II-4. South-North Diagrammatic Section showing Nahcolite, Dawsonite, and Halite Distribution in the Piceance Creek Basin, Colorado (Source: Beard et al 1974)



KNOWN DAWSONITE AND NAHCOLITE RESOURCES

Figure II-5

Halite is also found in the basin in association with nahcolite and dawsonite. At present, interest in the halite has been almost non-existent.

Oil and Gas

Occurrences of oil and gas resources within the Piceance Basin Planning Area are common. Most sandstones in the late Cretaceous appear capable of producing gas over much of the basin (Johnson and Keighin 1981). Gas production presently predominates in the basin. However, some oil has been obtained from almost every producing formation. Formations presently producing oil and/or gas include the Morrison Formation, Dakota Sandstone, Mancos Formation, Mesaverde Group, Wasatch Formation, and the Green River Formation. Generally, drilling depths in the basin have been limited to the Dakota Sandstone, however numerous shows and oil stains have been encountered in older formations and the possibility of production from these older formations exists. Figure II-6 shows oil and gas fields in the Piceance Basin.

Coal

Cretaceous coals have been mined in many places within the Piceance Basin, although none are being mined from the planning area at present. No Tertiary coal has been reported in the Piceance Basin, although the Wasatch and the Green River Formations contain coal in the Washakie-Sand Wash Basin of northwestern Colorado and southwestern Wyoming.

30,740 acres of land in the northwest corner of the planning area have been identified as having coal development potential. None of the rest of the planning area has coal development potential because of the extreme thickness of overburden (at least 3,000 feet and in many cases over 6,000 feet) (Speltz 1974). Total coal reserves within the area of development potential amount to some 400 million tons recoverable by subsurface mining methods. No reserves have been identified as being recoverable through surface mining methods.

Asphalt

Tar sands or rock asphalt is found along the eastern edge of the planning area in the Petrolite Hills (Figure II-6). The asphalt is deposited as layers between sandstone beds of the Lower Green River Formation, as veins and exposed as seeps in the sandstone (USDI, BLM 1978). Quality and quantity are unknown; however, the deposits in the Petrolite Hills and north of the planning area in the Gray Hills are possibly the largest in Colorado.

Analcime (Analcite)

The zeolite analcime [$Na(AlSi_2O_6)H_2O$] occurs in tuffs and oil shales of the Green River Formation within the planning area (Figure II-6). The deposits are minor and are not considered commercially valuable at this time (USDI, BLM 1982c). The mineral may be leased for sodium or located as a zeolite pursuant to the General Mining Law of 1872 for alumina. Zeolites, both artificial and natural, are used as gas absorbents, drying agents and water softeners, and are useful in pollution control.

Locatable Minerals

Being a predominately sedimentary structure, the Piceance Basin is not noted for areas of magmatic, metamorphic or hydrothermal mineralization. However, some sedimentary mineralization is present within the planning area including uranium-vanadium, limestone-dolomite and gypsum.

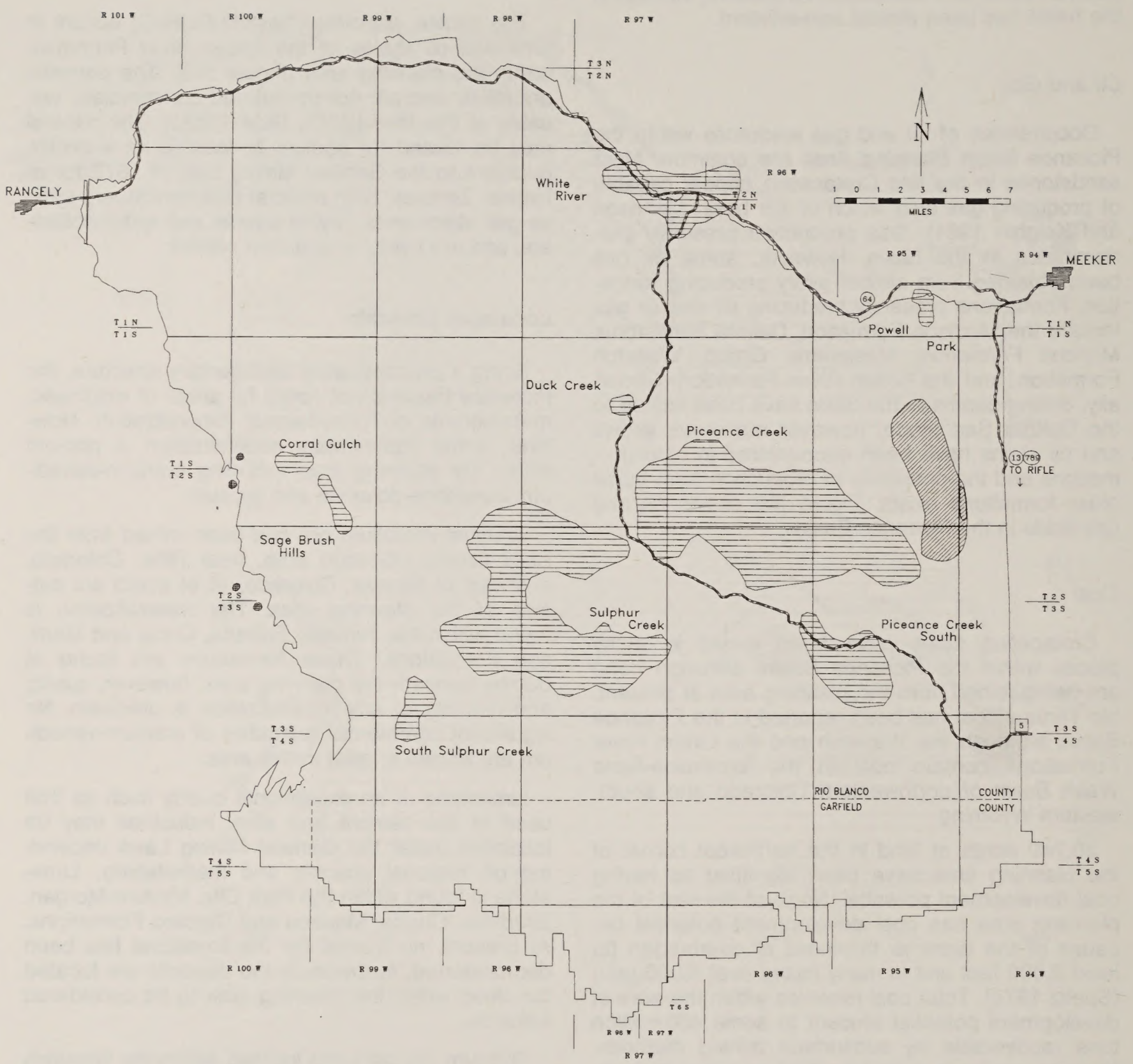
Uranium-vanadium ore has been mined from the Skull Creek, Colorado area, near Rifle, Colorado, and east of Meeker, Colorado, all of which are outside of the planning area. The mineralization is found within the Jurassic Entrada, Curtis and Morrison Formations. These formations are found at depths beneath the planning area, however, quality and quantity of any mineralization is unknown. No significant commercial quantities of uranium-vanadium are known to exist in this area.

Limestone of an exceptional quality such as that used in the cement and steel industries may be locatable under the General Mining Laws depending on regional quantity and marketability. Limestone is found within the Park City, Minturn-Morgan, Leadville, Chaffe, Manitou and Dotsero Formations. At present, no market for the limestone has been demonstrated, furthermore the deposits are located too deep within the planning area to be considered valuable.

Gypsum deposits are located within the Wasatch Formation in the planning area. These deposits are generally too thin to be considered a commercial commodity.

Saleable Minerals

Sand and gravel deposits consisting of colluvium and alluvium occur throughout the planning area. Alluvial deposits are found primarily along the drainages of the White River and various creeks of the Piceance Basin or on the benches and terraces above the drainages. Colluvial deposits can be found at the base of almost every rock outcrop and



Oil and Gas Deposits

Asphalt and Tar Sands Deposits

Analacime Deposits

SELECTED MINERAL RESOURCES OF THE PICEANCE BASIN PLANNING AREA

Figure II-6

within the alluvial fans associated with the various drainages.

Scoria, a naturally baked clay resulting from in-place burning of coal beds can be found along some portions of the periphery of the planning area. Both sand and gravel, and scoria are used for road construction and maintenance.

An almost unlimited amount of building stone and riprap is located within the planning area. The Uinta, Green River and Mesaverde Formations all contain considerable suitable sandstone units.

Clay deposits of the Wasatch Formation, the Mesaverde Group, and the alluvium are located within the planning area. Quality and quantity are unknown; however, both formations offer possible sources of this resource should a market develop in this area.

Geologic Hazards

Landslides

Landslide potential exists in any area with steep slopes. Of special significance are areas where steep dip-slope conditions (dip of strata is approximately equal to slope) exist. Areas within the planning area especially susceptible to landslides include Cathedral Bluffs, Roan Cliffs, Calamity Ridge and along the Grand Hogback (Colton et al 1975, Carrara et al 1975).

Seismicity

The planning area is considered to be in an area of low seismicity. This is based on the fact that no major earthquakes have occurred or originated from the area in the last 110 years.

Subsidence

Ground subsidence may be caused by natural phenomena such as removal of underground fluids, natural consolidation of sediments or dissolution of underground minerals. More commonly, subsidence is caused by man-made phenomena such as underground mining and removal of fluids such as oil and water from subsurface reservoirs. Presently, no areas of natural or man-made subsidence have been identified in the planning area however, future underground mining of oil shale, saline minerals and coal could produce noticeable ground subsidence.

TOPOGRAPHY

The term "Piceance Basin", as used in this document, identifies an area of approximately 1,600 square miles that is bounded on the north by the White River, on the east by the Grand Hogback, on the south by the Roan Plateau and on the west by Cathedral Bluffs and Calamity Ridge. Most of the Piceance Basin Planning Area is located within the White River drainage, with the southern fringe draining south into the Colorado River. It is a mountain basin ranging in elevation from about 5,400 feet near Rangely, Colorado to over 8,500 feet on the Roan Plateau.

Prominent features throughout the planning area include Calamity Ridge, Cathedral Bluffs, Roan Plateau, Joe Bush Mountain, Bar D Mesa, 84 Mesa, Magnolia, and Segar Mountain. The basin's topography is characterized by a series of nearly parallel north and northeasterly trending ridges and valleys with local elevation differences ranging from 200 to 600 feet. Overall aspect of the basin is northern.

Cathedral Bluffs, which is on the west side of the basin, is a long ridge of steep bluffs which extends from near the White River to the Roan Plateau. The bluffs have a few high points which exceed 8,000 feet in elevation.

The southern end of the basin is the Roan Plateau which extends generally east and west from Douglas Pass to the Grand Hogback. A few places along this area exceed 8,500 feet in elevation.

The east side of the planning area is mostly rolling type mountains extending to the Grand Hogback which is a north-south ridge just outside the planning area that parallels Colorado State Highway 13/789.

Piceance Basin (part of the Colorado Plateau), was subjected to vertical uplift in relatively recent geologic time. As a result, it now appears in relief as a large shallow bowl lying atop the Roan Plateau. The edges of the basin lie near the rim of the plateau and, as a result, streams draining the exterior faces of the plateau are short, few in number, and exhibit steep gradients. Piceance and Yellow Creeks and their tributaries, which drain the basin proper, are longer and more gently sloping. The rest of the basin is characterized by echelon drainages cutting their way through to Piceance Creek leaving fairly narrow stream valleys which are sediment laden. These drainages radiate clockwise from the southeast corner around to the northwest corner of the area.

The major drainage for the planning area is the White River. Only two tributaries to the White River stand out as significant, draining approximately 90

percent of the basin. The largest of these tributaries, for which the basin has been named, is Piceance Creek. Piceance Creek has its headwaters east of the Grand Hogback. It cuts through the hogback in the southeast corner of the basin and flows generally northwesterly to about the center of the basin where it flows northward to its confluence with the White River about 18 miles west of Meeker, Colorado. Piceance Creek has dozens of smaller tributaries which create the many ridges and valley combinations which exist throughout the basin. The planning area is somewhat unique in that it is almost entirely drained by Piceance Creek which is a tributary of the White River.

The other tributary is Yellow Creek which has its headwaters along the Cathedral Bluffs. Yellow Creek flows generally to the northeast from Cathedral Bluffs, then northerly to its confluence with the White River about halfway between Meeker and Rangely, Colorado.

FLOODPLAINS AND ALLUVIAL VALLEYS

Floodplains in the Piceance Basin Planning Area are not extensive because most streams flow through steep, narrow valleys. There are approximately 160 miles of stream channels on public land designated as potential flood-prone areas with drainage areas of greater than five square miles within the planning area. Total public lands along the main channels of the White River, Piceance and Yellow Creeks which have a history of flooding, is less than 15 miles. The potential for flooding exists throughout the basin, with major events resulting from high intensity localized thunderstorms.

Runoff from these storms can be quite high as shown by a 6,800 cubic feet per second (cfs) instantaneous discharge measured at Yellow Creek near the White River Station on September 7, 1978. The U.S. Army Corps of Engineers (1982-1983) has analyzed portions of the basin for floodplains. Their floodplain delineations, as shown in Figure II-7, are based upon a 100 year flood occurrence and a minimum watershed of five square miles.

Alluvial valleys are topographically low areas which have a thick mantle of unconsolidated sediments (colluvium and alluvium) and receive additional runoff moisture from upland areas. This additional moisture and the generally gentle slopes make some of these alluvial valleys suitable for subirrigated or flood irrigated agricultural production (principally hay meadows).

Alluvial valleys are known to exist within the major drainages of the Piceance Basin, usually in association with floodplains or in flood-prone areas. The exact location and extent of the alluvial valleys has not been determined in the planning area.

Most of the irrigated alluvial valleys in the basin are used for hay production which is of importance to the local livestock industry. Hay production makes it possible for livestock operators to feed their herds when no other forage is available during the winter months. Some alluvial valleys, which have not been developed for agricultural use, produce riparian vegetation which is important to wildlife (USDI, BLM 1983c).

AGRICULTURAL LANDS

The irrigated lands along the White River and Piceance Creek are used to produce alfalfa and grass hay for livestock, and to provide winter pasture. Irrigation water comes from the White River and its tributaries. Non-irrigated cropland is used primarily for dryland wheat, with a small amount of barley production. Most non-irrigated cropland is in the eastern half of Rio Blanco County.

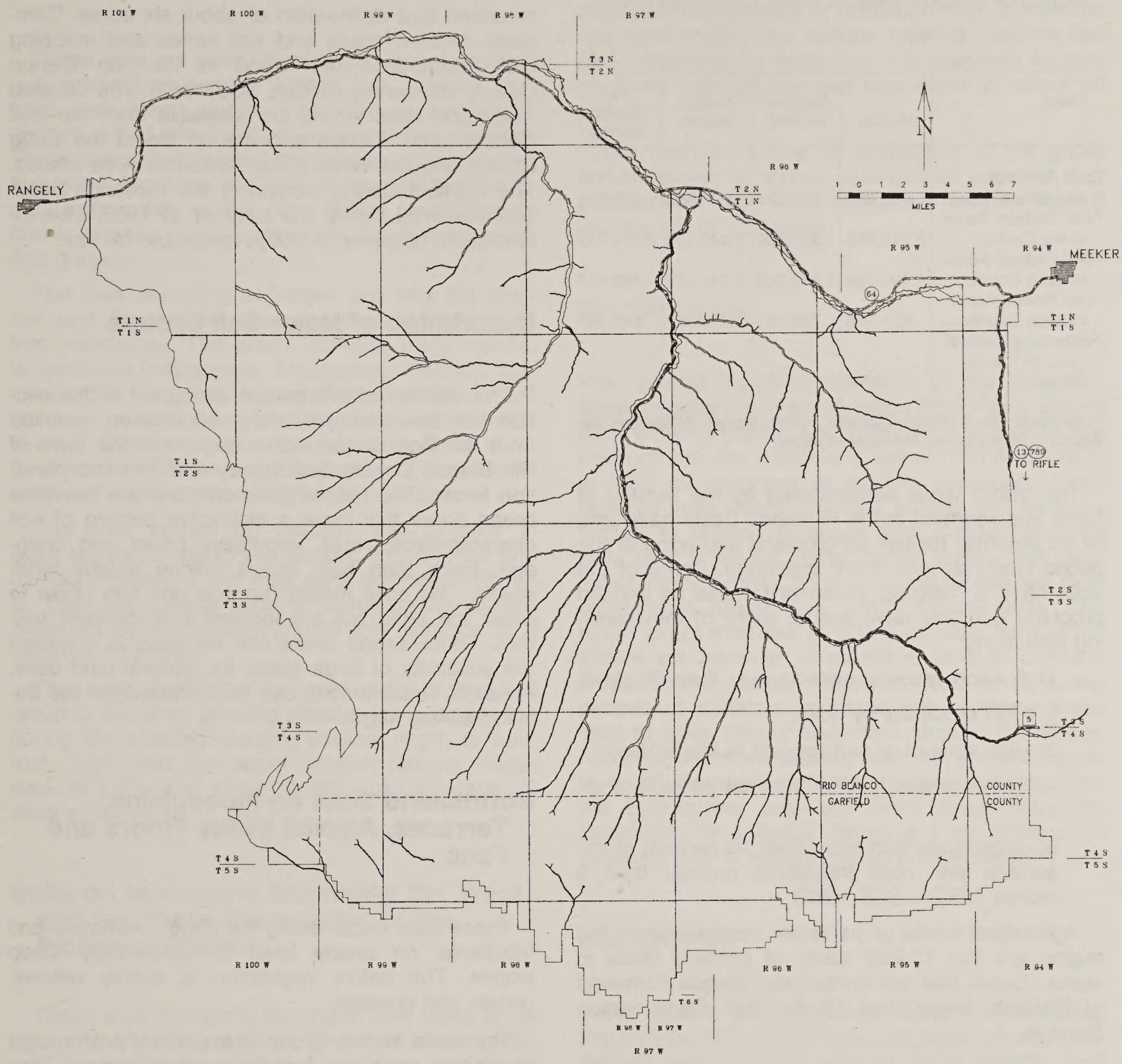
The Important Farmlands Map of Rio Blanco County (USDA, SCS and Colorado State University Experiment Station 1979) shows that no prime or important farmlands occur on public land in the planning area. However, prime farmlands are located in scattered segments on private lands along Piceance Creek from Hunter Creek to Dry Fork, and along the White River from Meeker west through Powell Park. No unique farmlands are present within Rio Blanco County. Irrigated hayland and pasture of statewide importance occurs in the drainages of Piceance, Black Sulphur and Yellow Creeks, and the White River.

The estimated 1983 cropland acreage in the area that may be affected is shown in Table II-10:

TABLE II-10

ACRES OF PRIVATE AGRICULTURAL LAND BY COUNTY

Mesa	(Acres)	Garfield (Acres)	Moffat (Acres	Rio Blanco (Acres)
Irrigated farmland.....	82,323	44,041	15,544	5,078
Dryland Cropland.....	3,411	8,136	77,489	15,670
Meadow hayland.....	19,213	11,569	4,199	28,820
Grazing land.....	419,404	464,301	970,115	349,445
Orchard.....	3,522	--	--	--
Other	2,989	7,037	3,534	328



Note: Data not available for the Cactus Reservoir, Gillam Draw, Meeker, and Rangely, Colo. quadrangles.

100 YEAR FLOODPLAIN DELINEATIONS

(U.S.Army Corps of Engineers 1982-1983)

Figure II-7

TABLE II-10—Continued

ACRES OF PRIVATE AGRICULTURAL LAND BY COUNTY

Mesa	(Acres)	Garfield (Acres)	Moffat (Acres	Rio Blanco (Acres)
Total Acres of Agricultural Land ...	530,862	535,086	1,066,682	399,341
Total Surface Acres in the County	2,119,680	1,920,000	3,035,520	2,174,772
Total Federal Acres in each County	1,497,735	1,210,240	1,731,219	1,583,817
Total Private Acres in each County	621,945	709,760	1,304,301	590,955
Percent Agricultural Land of Private Surface	86%	75%	82%	67%

Sources: Mesa (1982), Garfield (1982), Moffat (1983) and Rio Blanco (1983) County Assessors Offices.

The public lands administered by the Bureau of Land Management in the Piceance Basin have little or no potential for use as cropland and none of the public land has ever been cultivated. Some of the soils have a marginal potential for use as dryland cropland but they have one or more of the following limitations:

1) A short growing season less than 90 days,

2) High erodibility by water,

3) High sodium or salt content in the profile,

4) Some slopes greater than six percent, and/or

5) Some soils with more than 10 percent of the surface with rock fragments coarser than 3 inches (USDA, SCS 1982).

Agricultural lands of particular importance in this region are the 10,000 acres of orchard lands in Mesa County that are considered Unique Farmland of National Importance by the Soil Conservation Service.

SOILS

Introduction

The soil resources within the Piceance Basin are extremely variable depending on parent materials, elevation, slope, aspect, location on slope and time in place. The soils within Rio Blanco County in the Piceance Basin were mapped to Order III which consists mainly of associations, complexes and consociations (USDA, SCS 1982). The Order III soil survey was mapped on a scale of 1:24,000 with a minimum size delineation of about six acres. Complete detailed maps and soil series and mapping unit descriptions are found in the Rio Blanco County soil survey (USDA, SCS 1982). The detailed maps and descriptions are available from the Soil Conservation Service and are on file at the Craig District and the White River Resource Area offices. The Garfield County portion of the Piceance Basin was surveyed during the summer of 1983. This information, however, is not yet available for use.

Description of Major Soil Groups

The majority of information contained in this section has been compiled from information received from the Soil Conservation Service in the form of Rio Blanco County Soil Survey and Soil Interpretation forms. The following descriptions are for three broad areas that have a distinctive pattern of soil characteristics, relief, vegetative cover and drainage. Each land type has a unique natural landscape. The soils making up one unit can occur in other soil units but are located in a different pattern. Those broad areas can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the detailed survey maps.

Bottomland Soils on Floodplains, Terraces, Alluvial Valley Floors and Fans

These soils occur along the major drainages and tributaries on nearly level to moderately steep slopes. The native vegetation is mainly willows, shrubs and grasses.

The soils in this group are generally of recent deposition and show few diagnostic horizons. They are formed in mixed alluvium from sedimentary rock, are deep (at least 60 inches thick) and well drained. The alluvium derived from shale is fine textured and generally calcareous throughout. They are slightly to moderately affected by salt and alkali. The alluvium derived from sandstone is stratified medium to coarse textured and can have rock fragments throughout.

The main limitations for production of this group is the lack of irrigation water, a short growing season, some saline areas, and scattered areas with a seasonal high water table and flooding hazard.

Soils on Foothills in Center of Piceance Basin

These soils are gently sloping and include numerous entrenched narrow valleys and canyons that have very steep slopes. They are generally well drained with a low available water holding capacity. These soils have formed in place or from alluvium and wind deposited material derived from calcareous sedimentary rocks. The native vegetation is mainly pinyon, juniper, mountain brush, sagebrush and grasses.

The soils occurring on ridges and hills are shallow and formed on residuum derived dominately from sandstone. The profile contains many stones, is generally calcareous throughout, medium textured and underlain by sandstone at 10 to 20 inches. The soils developed on shale are generally steeper, finer textured and underlain by shale at 10 to 20 inches. There are also areas of very steep slopes of shallow soil which are almost barren.

The soils formed on uplands and terraces in open sagebrush parks are deeper, well drained and formed in alluvium and from wind deposited material. They are medium textured loams on the surface underlain by moderately fine to fine textures to a depth of 60 inches.

The main limitations for production of this soil group is the short growing season, low precipitation during the growing season, shallow depth to bedrock, high wind and water erosion hazard, steepness of slope and areas of rock-outcrop which restrict accessibility.

Soils on Mountains Bordering the West and Southern Boundaries of the Piceance Basin

These soils are gently sloping to very steep shale cliffs of the Cathedral Bluffs. The soils in this group are dry and less developed at lower elevations grading into deep, dark colored soils at upper elevational ranges with recently developed soils occurring on wind swept ridges and steep valley sides. These soils are formed in alluvium, and in place from sedimentary rock. The native vegetation is mainly mountain brush and shrubs with an understory of grasses.

The soils occurring on ridges and mountain sides are generally shallow and well drained. They are sloping to very steep and formed in place from sandstone and hard shale. The surface layer contains may stones and is medium textured underlain by extremely channery and medium textured material to a depth of 10 to 40 inches. The soils on uplands occupy gentle slopes, are deep and well drained. They formed in colluvium from sandstone and hard shale. The surface layer is medium textured underlain by soils that are channery to very channery medium textured to a depth of about 50 inches.

The main limitations for production of this group are steepness of slopes, shrink-swell potential, low permeability, high wind and water erosion hazard and hazard of landslides.

Soil Moisture

In the semi-arid environment of the Piceance Basin, moisture is in short supply for at least part of each growing season and limits plant growth. In this environment, the ability of a soil to hold moisture is at least as important as nutrient availability. Finer textured soils (loam and clay loams) are more effective at holding moisture than coarser textured soils (sandy loams, rocky sandy loams, and very rocky sandy loams). Soils on steep slopes will generate more runoff than gently sloping soils. The runoff is not available to plants on sites from which it runs off, however, bottomland soils in concave areas receive additional moisture from runoff during periods of moisture recharge. All of these areas tend to have thicker and more strongly developed horizons, are more strongly leached, and are darker in color. Because of these moisture relationships, the bottomland soils are more productive than sideslopes or uplands because they have more moisture than is available from precipitation.

Soil Erosion

Soil erosion is controlled by many factors, including climate, vegetative cover, inherent erodibility of the soil and the land use. Of these factors, land use and plant cover are most directly under human control. By reducing plant cover or changing land use, management can accelerate erosion above natural rates. This can cause a reduction in productivity of eroded sites and downstream sedimentation problems.

Most of the erosion in the Piceance Basin occurs during the spring snowmelt and during intense summer thunderstorms causing runoff and flash flooding. Many of the streams in the Piceance Basin have cut deep channels since settlement of the area. Many of these channels continue to erode from gully migration upstream and from the channel

bank caving in. Upland erosion also occurs due to sheet and rill erosion.

Water erodibilities of the soils are quite variable. The silt and silt loam surface textures are most susceptible to water erosion. Soil with a high content of coarse fragments have very low inherent water erodibility. In addition, fine sands, loamy sands and coarse sandy loams are most susceptible to wind erosion.

Sediment Yield

Soil erosion cannot be directly converted to sediment yields because sediment yield calculations do not account for deposition of material prior to its entrance to perennial water courses. The Colorado Land Use Commission (1974) compiled data on sediment yield, defined as the average annual amount of sediment from a square mile transported by water from source areas into local water courses. The Piceance Basin sediment yield is shown below in five different categories and represents an average over 25 years or more. Reference Colorado Land Use Commission (1974) for the sediment yield map which shows the location of these categories in the planning area.

1. Severely eroding stream banks and gullies with an average depth of five feet or more yield from 1.0 to 2.0 acre feet per bank mile per year. This occurs along Yellow Creek, portions of Piceance Creek and their tributaries.

2. Very high yield (1.0 to 3.0 acre-feet per square mile per year) includes badlands or other severely eroded lands with extensive sheet and rill erosion and numerous deep gullies. These locations are found only in a small area of the Piceance Basin.

3. High yield (0.5 to 1.0 acre-feet per square mile per year) includes the majority of the center of the Piceance Basin which is rangeland with much sheet and rill erosion and numerous shallow to moderately deep gullies.

4. Moderate yield (0.2 to 0.5 acre-feet per square mile per year) includes the area at middle elevational range in the Piceance Basin. This is mostly rangeland with only a few shallow to moderately deep gullies and some rills and gullies.

5. Low yield (0.1 to 0.2 acre-feet per square mile per year) includes the area on Cathedral Bluffs and the Roan Plateau. These areas have good vegetative cover and only occasionally have gullies or sites with obvious sheet and rill erosion.

HYDROLOGY

The Piceance Basin Planning Area lies in the White River Drainage Basin of the Green River Sub-basin and the Upper Colorado River Basin. Piceance and Yellow Creeks, the two major drainages of the Piceance hydrologic basin are tributaries to the White River.

Surface Water Quantity

Distribution of precipitation in the Piceance Creek structural basin is significantly affected by elevation. Areas where the elevation is greater than 8,000 feet, such as along the Roan Plateau and Cathedral Bluffs, receive as much as 26 inches of precipitation per year, mostly as snow in the winter months. Areas between about 5,500 and 8,000 feet elevation generally receive from 12 to 20 inches of precipitation annually.

Cover conditions that affect the watershed in the planning area vary from isolated densely forested drainages to nearly barren desert areas. The major vegetation classifications (and elevation ranges) that fall within the representative watershed are (1) desert shrubs (4,500 to 6,500 feet); (2) pinyon, juniper, sagebrush (6,000 to 8,000 feet); and (3) oakbrush, aspen, Douglas fir, and sagebrush (7,000 to 9,000 feet). Watershed runoff and total water yield are generally related to the same factors of elevation, exposure, land use and climate that produce the variations in vegetation cover.

Precipitation in the form of snowfall accumulates during winter months at higher elevations and produces a period of high recharge to the groundwater system and high streamflow in early spring. Surface water runoff is greatest during this spring snowmelt season and lasts until early July. Stream flow for the remainder of the year is maintained almost totally by groundwater discharge, with approximately 80 percent of the surface flow in the basin being supplied by groundwater (Robson and Saulnier 1981).

Because evapotranspiration rates are extremely high during the summer months, only high intensity thunderstorms produce any significant contributions to summer streamflows.

The drainage area of Piceance Creek is 652 square miles as measured 900 feet upstream from the mouth, which is 13 percent of the White River Basin. Average annual flow of the Piceance Creek at the White River streamflow station is 18,110 acre feet (13 year record) or about four percent of the

average annual flow of the White River. Minimum and maximum daily discharges for the same 13 year period are 0.75 and 628 cfs respectively (USDI, USGS 1981).

Yellow Creek is the smaller of the two streams within the Piceance hydrologic basin. The drainage area as measured 0.3 miles upstream from the mouth of Yellow Creek is 262 square miles. Average annual flow is 1,350 acre feet (10 year record) to the White River. Minimum and maximum daily discharges for the period 1972-1981 range from no flow to an abnormally high flood peak of 6,800 cfs which occurred in 1978. For more information see the Floodplains section in this chapter.

Roan and Parachute Creeks are not within the Piceance hydrologic basin however, portions of the headwaters are contained in the planning area and are hydraulically connected with the basin. The drainage area of Parachute Creek is 198 square miles as measured 1.4 miles upstream from the Colorado River at Parachute. Approximately 26 percent or 51.5 square miles of the drainage area is contained in the planning area. Average annual flow of Parachute Creek at the Parachute stream flow station is 22,390 acre feet (22 year record). Minimum and maximum daily discharges for the same 22 year period range from no-flow to 2,600 cfs respectively (USDI, US Geological Survey 1981).

Roan Creek is the larger of the two streams with a drainage area of 321 square miles as measured 10 miles upstream from the Colorado River near DeBeque. Average annual flow is 30,650 acre feet (22 year record) to the Colorado River. Approximately 25 percent or 78.7 square miles of the drainage area is contained in the planning area. Minimum and maximum daily discharges for the 22 year record range from 3.2 to 2,020 cfs.

Stream and channel characteristics in the lower elevations (northerly portion) of the unit are meandering, causing bank caving, sloughing and steep banks. This adds considerably to the sediment loads in the streams during periods of high runoff. These occurrences are during rapid snowmelt and early spring runoff, as well as during occasional intense summer thunderstorms. In the higher elevations of the southern portion of the planning area, the streams and channels tend to be straight, less incised, with bottoms and banks covered with vegetation. The upper elevations are in a higher precipitation zone, consequently the increased density of vegetation is evident and aids in reduction of flood runoff and reduces soil loss.

The majority of the reservoirs, lakes, ponds and water control structures are totally dependent upon surface runoff for their water supply, although few of these ponds are supplied by springs, seeps and wells. Lake and reservoir depths vary throughout the unit; however, most of the stock water and wildlife ponds are less than 15 feet. The bottoms of the lakes and reservoirs in the higher elevations are generally in good condition with very little siltation occurring. The reverse is true, however, in stockponds at the lower elevations where many livestock reservoirs are receiving sedimentation. Many ponds have already been rendered useless due to sediment filling the ponds to spillway elevation.

Livestock and wildlife needs are usually supplied by the development and use of groundwater sources; in the form of developed springs, wells, and a few ponds which have groundwater augmentation from springs and seeps. Surface water sources contribute to some livestock and wildlife needs but this is limited primarily to the spring snowmelt season.

The major water uses in Piceance and Yellow Creeks at this time are water for livestock and irrigation of hay meadows. Diversions from Piceance and Yellow Creeks supply water to approximately 5,300 acres. The amount of water diverted and the number of acres irrigated at any one time are functions of water availability, water right priorities, crop type and weather conditions.

Surface Water Quality

The surface water quality of both Piceance and Yellow Creeks can be classified as a mixed bicarbonate type in the upper reaches, and a sodium bicarbonate in the lower reaches. The concentration of dissolved solids, fluoride and sodium increase in the downstream direction. Irrigation return flows, evapotranspiration and groundwater discharge from the Green River formation are the main causes of the water quality degradation in Piceance Creek. Increases in the water quality constituents for Yellow Creek are attributed primarily to groundwater inflows (Weeks et al 1974).

Total dissolved solid (TDS) concentrations for both Piceance and Yellow Creeks vary substantially with streamflows. When streamflows are high (snowmelt periods), TDS concentrations are the lowest. The increases in TDS during low flow conditions are good indications of the discharging of groundwater to the streamflows in both Piceance and Yellow Creeks. The groundwater that discharges into these streams contains trace minerals such as arsenic, barium, boron, fluoride, iron, lithium and strontium in significant concentrations. Lesser concentrations of beryllium, copper, cadmium, lead, mercury, manganese, molybdenum, sele-

nium and zinc were also detected. Primary evaporite minerals and primary and secondary sulfide minerals are likely sources of the trace constituents found in the groundwater (Robson and Saulnier 1981).

Total dissolved solids (TDS) concentrations for both Roan and Parachute Creeks average approximately 1,000 mg/l. Conductivity extremes for Roan Creek range from 459 to 2,480 micromhos and Parachute Creek ranges from 811 to 3,440 micromhos.

Table II-11 displays the maximum and minimum TDS in mg/l and annual sediment yields in tons/square mile for Piceance and Yellow Creeks for the water year 1980, for the days sampled.

TABLE II-11

CHARACTERISTICS OF MAJOR STREAMS

Characteristics	White River Near Ouray, UT	Piceance Creek at White River	Yellow Creek Near White River
Drainage Area (Square miles)	5,120	652	262
Average Annual Discharge (cfs) [1]	241,880	10,518	660
Maximum Daily Discharge (cfs) [1]	4,200	186	500
Minimum Daily Discharge (cfs) [1]	110	0.70	0
Average Daily Discharge (cfs) [1]	662	28.8	1.81
Maximum Instantaneous Discharge (cfs) [1]	4,260	628	6,800
1980 Sediment Discharge (tons) [2]	2,046,110	56,115	12,495
Maximum Daily Sediment Discharge (tons/day) [1]	268,000	2,900	290,000
Minimum Daily Sediment Discharge (tons/day) [1]	0.69	0.10	0
Maximum TDS (milligrams per liter) 1980 [2]	702	1,710	2,090
Minimum TDS (milligrams per liter) 1980 [2]	261	731	489

[1] For the period 1975-1980.
[2] 1980 water year.
Source: USGS Water Resource Data
Conversion: cfs x 1.9835 = acre feet.

Groundwater Quantity

The Piceance Basin Planning Area includes the drainage basins of Piceance, Yellow, Roan and Parachute Creeks. Formations of Eocene and older rocks lie directly beneath the drainage basins in the planning area. The Uinta and Green River Formations consist of marlstone, sandstone and siltstone and include large reserves of oil shale. Extensive fracturing and leaching of the formations has increased their permeability and resulted in aquifers that lie within, above and below the oil shale deposits.

The principal usable bedrock aquifers which occur in the planning area are commonly referred to as the upper and lower aquifers of the Uinta and Green River Formations, respectively (Figure II-8). These aquifers are considered isolated from one another by the semi-impermeable oil shale rich layer referred to as the Mahogany Zone. The Uinta Formation is exposed over most of the basin; the Green River and older formations are exposed in the basin margins and in numerous incised valleys within the drainages of Roan and Parachute Creeks (Taylor 1982).

The Uinta Formation consists of fractured sandstone, marlstone and siltstone that contain groundwater in porous or fractured bedrock and is considered the main groundwater recharge system to the upper aquifer. Isolated perched aquifers exist throughout the Piceance Basin within the Uinta Formation, although the extent and locations are not well known.

The underlying Green River Formation which contains the lower aquifer is subdivided into members that include the Parachute Creek Member, the Garden Gulch Member and the discontinuous Anvil Points Member. The Parachute Creek Member consists of fractured marlstone, sandstone and leached zones which contain groundwater. This member includes many small discontinuous oil shale lenses; and the Mahogany Zone which is the most extensive oil shale rich layer in the basin. The Garden Gulch Member consists of relatively impermeable marlstone, shale and sandstone layers that form the base of the aquifer system. The Anvil Points Member in the eastern portion of the basin is a relatively impermeable zone equivalent to the lower Parachute Creek Member, Garden Gulch Member and the underlying Douglas Creek Member.

A zone of saline minerals known as the high-resistivity zone exists in the lower portions of the Parachute Creek Member in the north-central part of the basin. This zone is relatively impermeable and consists mostly of unfractured nahcolite, halite, and kerogen rich marlstone ranging from 200 to 900 feet in thickness (Coffin et al 1971). Above the high-resistivity zone lies the low-resistivity or leached zone that has been fractured, allowing groundwater circulation and resulted in relatively high permeability.

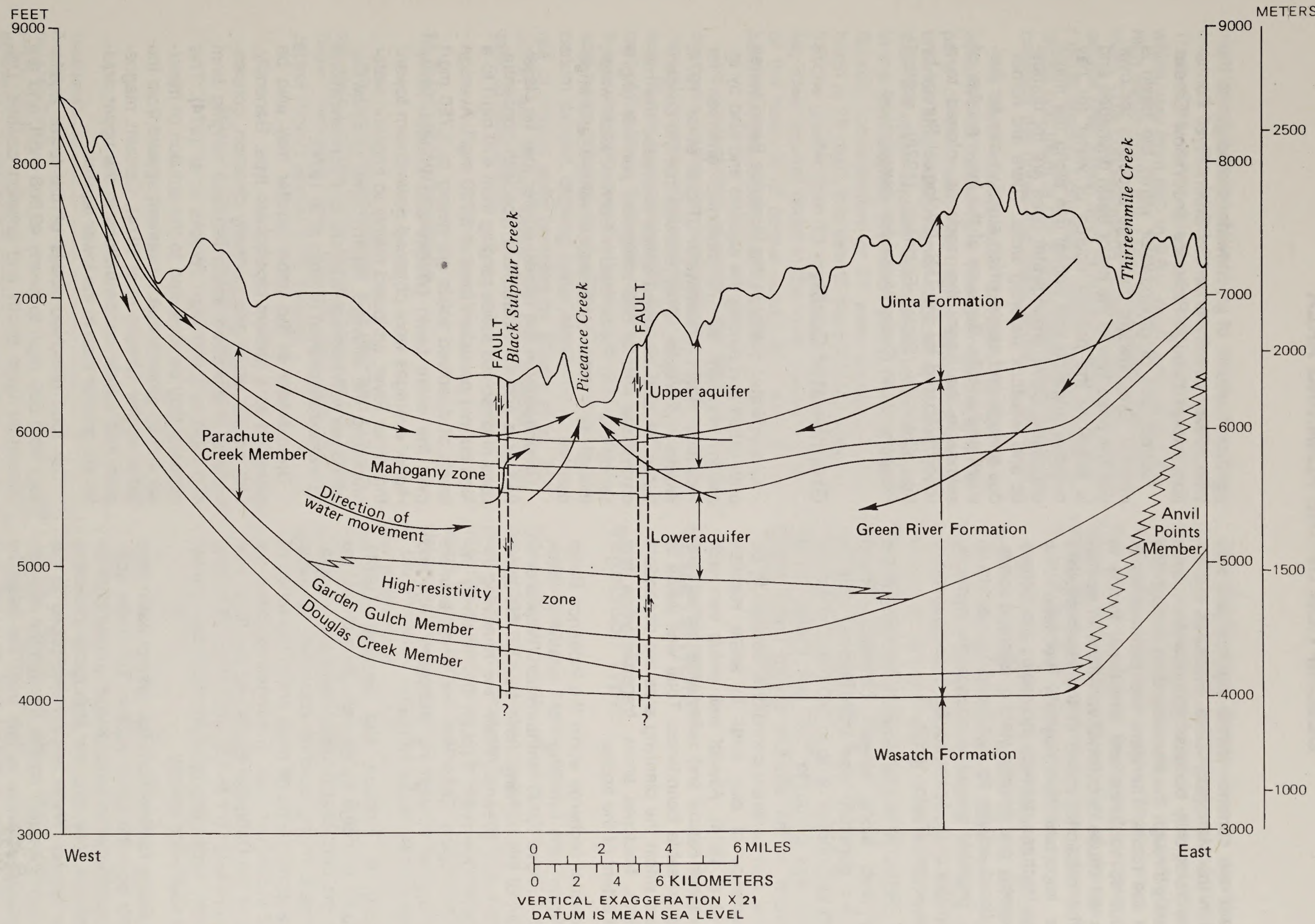


Figure II-8. Geohydrologic Section through the Piceance Basin, showing Relation of the Aquifers to the Green River and Uinta Formations (Weeks et al 1974)

Fractures are common in the aquifers and less common in the Mahogany Zone. Fractures are important hydrologically because groundwater moves more readily through the fractures than through the pores of the rocks. Therefore the permeability is mostly due to fractures; and directional trends in fractures will cause directional variations in permeability. The solutional zones in the lower aquifers also are important hydrologically because they widen the fractures, thereby increasing the permeability, porosity and specific yield of affected zones. The solutional activity as evidenced by cavities in the rock, probably served to change the hydraulic characteristics of the lower aquifer in comparison to the upper aquifer (Taylor 1982).

Water occurs in alluvial aquifers throughout the planning area along stream channels. These aquifers are generally less than one-half mile in width with thicknesses of up to 140 feet and a saturated thickness of up to 100 feet (Coffin et al 1971). Water in the alluvium occurs under both water table and confined conditions, depending on the occurrence of clay beds in some reaches (Weeks et al 1974). Alluvial well yields vary with time as valleys narrow and valley walls act as relatively impermeable boundaries. Total well yields in all aquifers within the planning area are dependent upon depth, fractured areas, transmissivities and the areal extent of the aquifer.

Groundwater recharge within the Piceance Basin results from the melting of relatively thick snowpacks above 7,000 feet elevation (Weeks et al 1974). Part of this recharge flows through the upper aquifer to major streams. While the remaining recharge flows downward through the relatively impervious Mahogany Zone into the lower aquifers and then upward through the Mahogany Zone and upper aquifer to the major streams.

According to Robson and Saulnier (1981), groundwater recharge rates vary throughout the basin. In the northeast portion where the topography is broad, rolling uplands dissected by steep narrow canyons, recharge rates are in the range of 2.0 to 3.2 inches per year. The remaining basin rim made up of the Cathedral Bluffs and the Roan Plateau have rates of 0.1 to 1.0 and 1.0 to 2.0 inches, respectively, depending upon location, topography, soils and vegetation density.

Groundwater outflow from the system basin-wide is primarily from the upper aquifer. The lower aquifer also contributes to groundwater outflow both directly and indirectly thru the Mahogany Zone into the upper aquifer. Water is then discharged to the streams from the upper aquifer through the alluvium or springs. Groundwater is lost from the basin by evapotranspiration or discharge from Piceance and Yellow Creeks. According to Weeks et al (1974), no significant amount of groundwater discharges to the White River directly from the Green River Formation, except through Piceance and Yellow Creeks.

Current use of groundwater within the basin is minimal. Groundwater discharge accounts for over half the base flow in the major basin drainages and is indirectly the primary source of water for hay meadow irrigation and animal use along the major drainages. Other groundwater uses are for domestic and livestock watering wells. There are numerous springs and seeps which supply water for livestock and wildlife. Because of the large number of springs in the basin, the reader is referred to a report prepared for the U.S. Geological Survey by the Colorado State Engineer (1978) entitled *Piceance Basin Spring Hydraulics Investigation*.

Groundwater Quality

Groundwater quality in the Piceance Basin varies both within and among the aquifers and also by location. Virtually all 75 reported analyses for Piceance Basin groundwater (Ficke et al 1974, Weeks and Welder 1974), showed that the concentration of total dissolved solids exceeded the recommended limit of 500 milligrams per liter (mg/l) set by the U.S. Public Health Service. Most water, though, is suitable for livestock, wildlife, and irrigation.

Groundwater in the alluvial aquifer may be classified as a sodium bicarbonate type with concentrations of dissolved solids ranging from 470 mg/l to a high but not persistent level of 6,720 mg/l. Average levels of dissolved solids are nearer to 1,750 mg/l over the entire basin (Weeks and Welder 1974). Higher averages were obtained downstream toward the White River, attributed mainly to irrigation water reentering the alluvium, return flows, groundwater interfaces with bedrock aquifers and concentrations by evapotranspiration (Weeks et al 1974).

Groundwater in the upper aquifer may also be classified as a sodium bicarbonate type. Generally, with aquifer depth and northerly direction, concentrations of dissolved solids increase ranging from 400 mg/l to 2,000 mg/l (Weeks et al 1974). This increase may be attributed to the solution of minerals and by groundwater movement upward from the lower aquifer (Weeks et al 1974). Calcium, magnesium and sulfate concentrations in the upper aquifer are greater than in the lower aquifer.

The total dissolved solids of the lower aquifer vary from 500 mg/l to nearly 40,000 mg/l, and are dependent upon depth and solution cavities. Dissolved solids concentrations of 63,000 mg/l have been reported from a sample obtained from the

high resistivity zone (Weeks et al 1974). Samples obtained by the USGS from the lower aquifer on Tract C-18 have dissolved solid concentrations which vary from 650 to 9,610 mg/l, with all but this high value being the 1,000 mg/l range. The maximum TDS concentrations obtained from the lower aquifer after seven days of pumping was 1,040 mg/l (Multi Mineral Corporation 1982). These results indicate that there is not a great difference in salinity between the upper and lower aquifer in this area.

The lower aquifer water can be classified as a sodium bicarbonate type. The lower aquifer in some parts of the basin has higher concentrations of chloride and much higher fluoride concentrations than the upper aquifer. The fluoride concentrations in the lower aquifer are worth noting. The average fluoride concentration for 27 wells sampled in the basin is 28 mg/l. It is rare to have fluoride concentrations greater than 10 mg/l. Like the upper aquifer, lower aquifer water in the north central portion of the basin is of poorer quality than that of the basin margins (USDI, BLM 1983c).

The concentration of some trace elements within the lower aquifer are great enough to be of environmental concern. Concentrations of barium, boron and lithium are consistently high in the northern part of the basin, indicating that minerals containing these elements may be associated with nahcolite and halite (Weeks et al 1974). Concentrations of barium exceed drinking water standards in seven out of eleven wells sampled by Weeks et al. The boron and lithium levels are high enough to be toxic to most plants.

Municipal Watersheds

Two major water storage and diversion projects are slated for the White River. These are the Taylor Draw Reservoir near Rangely and the Yellow Jacket Project upriver from Meeker.

The Taylor Draw Reservoir is to provide a dependable municipal, agricultural and industrial water supply to water users within the boundaries of Water User's Association No. 1, including the town of Rangely, to provide needed flood control, recreation and a source of hydroelectric power in the future. A total of 13,800 acre-feet of storage on the White River was applied for and granted by the State of Colorado at the dam site.

The Yellow Jacket Project calls for 80,000 acre feet of diversion and storage to the White River. Various plans and alternatives have been proposed but the final decision is pending. The project is to provide water for agriculture, industry and the municipal and domestic needs of the Meeker area. Estimated water delivery requirements were 18,000 acre feet for irrigation to 8,000 acres of land; 5,000 acre feet for diversion by municipal and domestic use in the Meeker area; 12,000 acre feet provided to coal interest and the remaining 52,000 acre feet provided for oil shale interest in the Piceance and Yellow Creek Basins.

VEGETATION

Vegetation Types

Discussion will center around major vegetation types occurring in the planning area with emphasis on existing composition, condition and trend, aerial plant cover, and productivity. Condition and trend information, presented in Table II-12 refers to livestock forage condition and trend. Methodology for determination of condition and trend can be found in the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980). Maps depicting the major vegetation types by locality are available for review at the White River Resource Area office.

TABLE II-12

SUMMARY OF VEGETATION TYPE BY CONDITION AND TREND (FORAGE PRODUCTION) ON PUBLIC LANDS

Vegetation Type	% of Unit Total Acreage	Condition				Trend		
		Poor	Fair	Good	Total	Improving	Static	Declining
Grassland	3	0	6,904	11,264	18,168	8,103	10,065	0
Sagebrush	42	16,694	168,226	71,913	256,833	142,542	110,952	3,339
Mountain Shrub	17	858	50,174	56,178	107,210	48,459	58,108	643
Pinyon-Juniper	28	74,195	86,589	112,362	172,146	3,443	131,692	37,011
Saltbush	1.5	0	9,002	0	9,002	0	9,002	0
Greasewood	1	5,277	124	0	5,401	0	4,526	875
Broadleaf	2	0	6,664	4,102	10,755	2,778	7,988	0

TABLE II-12—Continued

SUMMARY OF VEGETATION TYPE BY CONDITION AND TREND (FORAGE PRODUCTION) ON PUBLIC LANDS

Vegetation Type	% of Unit Total Acreage	Condition				Trend		
		Poor	Fair	Good	Total	Improving	Static	Declining
Conifer	1.5	9,221	0	0	9,221	0	9,221	0
Waste	4	26,753	0	0	26,753	0	26,753	.....

Grassland Type

Grasslands occur in the area as a subdominant vegetation type occurring within more extensive plant communities. Grasslands cover about 18,168 acres (three percent of the planning area). Most stands seldom exceed several thousand acres in size. Grassland openings are common at all elevational ranges but are most prevalent at elevations below 7,000 feet. Major species comprising the type at lower elevations are western wheatgrass and needle-and-thread grass. Above 7,000 feet, major species are subalpine needlegrass, Letterman needlegrass and various bluegrasses.

The majority of the grassland type (11,264 acres) is in good condition and 6,904 acres are in fair condition. At present, trend is static over most of the type (10,065 acres) but improving on 8,103 acres.

Grass and forb cover averages 31 percent, and ranges from 26 to 38 percent. Production estimates (McKell and Goodin 1973) range from 600 to 2,200 lbs/acre on mountain meadows. Lower elevation grasslands average up to 400 lbs/acre.

Sagebrush Type

The sagebrush type covers approximately 256,833 acres (42 percent) and is the major shrub community in the planning area. Sagebrush stands are characterized by mixed high and low growing shrubs dominated by big sagebrush with a wide variety of understory grasses and forbs. The sagebrush type occurs at all elevations, with the larger expanses occurring below 7,000 feet.

Major plant species associated with sagebrush at lower elevations are western wheatgrass, Colorado wildrye, Indian ricegrass, and needle-and-thread. Associated species above 7,000 feet are various wheatgrasses, bluegrasses, needlegrasses and lupine.

Overall condition and trend is fair (268,226 acres) and improving (142,542 acres). Poor condition range occupies 16,694 acres while good condition range covers 71,913 acres. Range trend is static on 110,952 acres and declining on 3,339 acres.

Cover varies throughout the type. In some instances big sagebrush dominates a site, contributing almost 100 percent of the total cover, while on other sites it may contribute less than 20 percent. Cover attributed to all species occurring in the type, based on data, averages 32 percent.

Productivity of the sagebrush type is also highly variable. Dense stands support very little understory vegetation while open stands can produce from 800 to 1,800 lbs/acre.

Mountain Shrub Type

The mountain shrub type, occupying 107,210 acres or 17 percent of the RMP area, occurs above 7,000 feet, and is usually most prevalent on north facing slopes along steep ridges and foothills. The major species characterizing the type are Utah serviceberry, Gambel oak, mountain mahogany and snowberry. Major understory species are sedge, arrow-leaf balsamroot, western yarrow and slender wheatgrass.

Fifty-two percent of the mountain shrub type is in good condition. Areas in poor condition (858 acres) are usually higher elevation stands bordering valley bottoms in the vicinity of water developments. Depleted understories and decadent shrubs typify poor condition range.

Fifty-four percent of this type has a static trend. Less than one percent of the type has a declining trend.

Cover is attributed primarily to overstory species and averages 41 percent. In some areas cover of overstory species is nearly 100 percent and is usually associated with dense stands of Gambel oak.

Productivity in the mountain type is higher than in most of the other vegetation types, due mainly to higher moisture associated with elevation. Production, both herbaceous and browse, ranges from 900 to 1,500 lbs/acre.

CHAPTER II

Pinyon-Juniper Type

The pinyon-juniper type, occupying 172,146 acres or 28 percent of the planning area, is the most prevalent vegetation type in the planning area. Colorado pinyon and Utah juniper are the dominant overstory species. Major understory species include Utah serviceberry, mountain mahogany, big sagebrush, bitterbrush, junegrass and beardless bluebunch wheatgrass.

This type occurs on a wide variety of sites with respect to elevation, slope and aspect. Most are found between 6,500 feet and 8,000 feet in elevation on ridgetops and sideslopes on all aspects wherever acceptable soils exist. The type varies considerably with respect to species composition, wood volumes and forage production. Depending on the quality of the site, the overstory will vary from pure juniper to pure pinyon and all mixtures, from very sparse and scattered to closed canopied, from seedling/sapling stages to large, overmature stands. Where a dense overstory occurs, little or no herbaceous understory vegetation occurs, although desirable browse production may be significant. Overall ground cover estimates average 34 percent for the type. Most woodland stands will exhibit variation in size and age classes, due to their unmanaged status. Best development usually occurs in ridgetop, north-facing slope stands between 7,000 and 7,500 feet in elevation.

On areas disturbed by fire, pinyon-juniper is confined primarily to rocky ridges and slopes. On areas relatively undisturbed by fire, pinyon-juniper extends into flatter areas with deeper soils. Dense stands on slopes of less than 20 percent could be most affected by intensive grazing management.

From a forage production standpoint, 43 percent of the pinyon-juniper woodland is in poor condition, 50 percent is in fair condition and 7 percent is in good condition. Less than two percent is improving, while 21 percent is declining.

Forage production varies with pinyon-juniper density and can range from virtually no understory production up to 300 lbs/acre in good condition stands. Vegetation manipulation can increase productivity to 1,200 lbs/acre. The dense stands of pinyon-juniper are typically in static or declining condition with low productivity of forage due primarily to age and overstocking of the pinyon-juniper trees.

Of all the pinyon-juniper type in the planning area, approximately 78,570 acres are considered to be productive areas for forest products (USDI, BLM 1981). Generally, a productive stand must have a crown canopy closure of at least 40 percent, existing or potential wood volumes sufficient for commercial interest, and be located on slopes gentle enough for commercial operations, usually less than 25 percent.

Saltbush Type

The saltbush vegetation type, covering approximately 0.5 percent of the planning area, is located in the area north of Calamity Ridge and south of the White River and consists of mixed saltbush and sagebrush stands. Dominant shrubs include Gardner's saltbush, mat saltbush, shadscale, bud sagebrush, big sagebrush and winterfat. Associated species are bottlebrush squirreltail, western wheatgrass, Colorado wildrye and cheatgrass. The saltbush association occurs below 6,000 feet and is found on lower elevation foothill slopes, semi-arid drainage bottoms and alluvial deposits. Saltbush occupies heavy, fine textured soils that are less saline-alkaline than are normally found supporting greasewood. Saltbush communities are characterized by low growing, widely spaced plants, varying in species composition and density. These communities range from pure stands of an individual saltbush species to intermixed communities of many species.

All of the saltbush type in the planning area (9,002 acres) is in fair condition and trend is static.

Overall cover in the saltbush type averages 25 percent, with the shrub component making up most of the cover percent. Productivity is presently below potential, but based on U.S. Soil Conservation Service data, productivity could range from 50 lbs/acre on poor condition range to 350 lbs/acre on good condition range.

Greasewood Type

The greasewood type covers approximately 5,401 acres and is most prevalent on deep, poorly drained, alluvial saline-alkaline soils at elevations below 6,600 feet. Greasewood occurs both in dense and open stands with varying amounts of understory vegetation. Major associated species are big sagebrush, shadscale, rubber rabbitbrush, western wheatgrass, cheatgrass, mustard and Russian thistle.

Ninety-seven percent of the type is in poor condition with the remaining three percent in fair condition. Declining trend characterizes 16 percent of the type. Static trend dominates the remaining 84 percent of the type.

Cover in the greasewood type is dominated by greasewood. Very dense stands can have a nearly closed canopy with little understory vegetation cover while more open stands support more di-

verse understory cover. The average cover of greasewood and associated shrubs and grasses is 28 percent.

Productivity in the greasewood stand varies with greasewood density, ranging from 400 to 700 lbs/acre.

Broadleaf Type

Quaking aspen is the major species associated with this type which covers 10,776 acres. It is restricted to elevations above 7,000 feet with the majority of the trees occurring above 8,000 feet. Various willows and cottonwoods form another type but are very limited on public lands. They usually occur in drainage bottoms and along perennial streams. At lower elevations, aspen occurs in the upper end of drainages but occurs over wider expanses at higher elevations. The understory plant community includes bluegrasses, needlegrasses, snowberry, yarrow and lupine. The majority of the type is in a fair and stable condition with productivity similar to that of the mountain shrub type. This type is not considered important for forest products.

Conifer Type

The conifer type, occurs above 6,000 feet. It is a broad classification that covers several types. The major species is Douglas fir with very small acreages of blue spruce, Engelmann spruce, subalpine fir, ponderosa pine and lodgepole pine. The major concentrations of conifers occur along upper elevation drainages on northern exposures. Major understory species include snowberry, elksedge, and meadow rue, however, very few conifer stands support significant understory production.

From a forest product standpoint, Douglas fir is the most important coniferous type. It is found primarily on the rim of the Piceance Basin, between 7,500 feet and 9,000 feet in elevation. Stands occur only on north-facing slopes and in protected coves in the lower elevations of the range. It will be found on additional aspects and on all protected sites (at the higher elevations). Most of these sites are on slopes greater than 25 percent. Most stands consist of mature and overmature trees, due to their unmanaged status. Douglas fir stands comprise 9,221 acres in the planning area (USDI, BLM 1981). In some areas, especially the southeast part of the basin, there exists a serious infestation of the Douglas fir beetle in many stands of Douglas fir. This infestation has resulted in many dead trees in a significant portion of some stands, and further results in many blow-downs, injuries to residual trees and advanced regeneration, spread of the insects to healthy trees, and an overall major reduction of stand condition.

Barren and Waste Lands

Barren lands are those areas such as barren rock, erosion pavements, or rock outcrops which have no significant amount of vegetation. Waste lands are areas which are too steep and/or rocky to be beneficial to livestock or big game. These areas include mostly steep inclines such as cliffs and rockslides. These two land categories are found throughout the planning area.

Riparian Zones

The riparian vegetation of the planning area is generally associated with small perennial streams, man-made reservoirs and stock ponds holding year-round waters, and spring sources. Riparian plant communities or zones are narrow bands that follow stream courses, and are very distinct from adjacent rangeland plant communities. Sizes of riparian zones generally accommodate the stream size, and are often limited by the steep banks of eroded gullies in which many stream beds are located. Narrow zones, one to five feet across, are typical at higher elevations and spread out gradually to as much as 50 to 75 feet in lower elevations. These communities are important because they support higher population densities and greater diversities of both plant and animal species than any other rangeland plant community.

Approximately 109 acres of riparian vegetation have been identified in 25 locations within the planning area. The following acreage classifications indicate the overall condition and trend ratings for the planning area:

fair/stable -- 63 acres

fair/declining -- 18 acres

poor/stable -- 23 acres

poor/declining -- 5 acres

Threatened/Endangered, Rare and Sensitive Plants and Remnant Vegetation Association

Eleven sensitive plant species are known to occur within the Piceance Basin. To date, no Federally listed threatened or endangered species have been recorded within the study area.

CHAPTER II

The Piceance Basin is an ecologically unique area that harbors many unique plant communities. Some of these communities support rare and sensitive plant species that are restricted to areas of specific geologic formations and aspects. These rare and sensitive plants are generally associated with the Green River Formation (Cashion and Donnell 1974) except *Festuca dasyclada* and *Astragalus lutosus* which also occur in the Uinta Formation.

The habitat for many of the sensitive plant species usually consists of relatively steep slopes of poorly developed shalely silt loam soils or bedrock. However, *Festuca dasyclada, Aquilegia barnebyi* and *Sullivantia purpusii* are found in moist narrow draws and waterfall areas. *Astragalus detritalis* is associated with big sage and juniper and old alluvial terraces containing cobble-sized stones. The large vertical exposures of the Green River Formation, which outcrop along Cathedral Bluffs and at the mouth of Yellow Creek, harbor the major concentrations of these sensitive plant species.

The status of rare and sensitive plants occurring in the Piceance Basin are listed in Table II-13. *Thalictrum heliophilum* and *Festuca dasyclada* are the only Category 2 plants in the Piceance Basin which the U.S. Fish and Wildlife Service (USFWS) are presently considering for possible Federal listing as threatened or endangered (England 1983). *Sullivantia purpusii* is rare (Category 3C) but it is not actually threatened at the present time. If development does occur in the future and the habitat becomes threatened, the status can be updated. The USFWS has not listed *Gilia stenothyrsa* and *Gentianella tortuosa,* since they are locally abundant in Utah, although they are rare in Colorado.

The Piceance Basin was inventoried during the 1982 field season by The Nature Conservancy and data was collected on rare and sensitive plant species occurrences and remnant vegetation associations. The description of these plants, associations, their distribution, phenology, habitat and environmental setting are described in the *Inventory of the Piceance Basin, Colorado Threatened and Endangered Plants, Plant Associations and the General Flora* (The Nature Conservancy 1982).

These rare and sensitive plants are not protected under the Endangered Species Act of 1973. Protection of rare and sensitive plant habitat is primarily through avoidance of surface disturbing activities on known locations as identified in the White River Resource Area Management Framework Plan.

TABLE II-13

STATUS OF RARE AND SENSITIVE PLANT SPECIES THAT OCCUR IN THE PICEANCE BASIN

Plant Name	USFWS Category Status Federal Register Dec. 15, 1980	USFWS Category Federal Register Nov. 28, 1983	Remarks
Aquilegia barnebyi	2 [1]	3C	Sensitive
Astragalus detritalis	3C	3C	Sensitive
Astragalus lutosus	2	2	Candidate
Festuca dasyclada	2	2	Candidate
Gentianella tortuosa	-[3]	-	Sensitive
Gilia stenothyrsa	-	-	Sensitive
Lesquerella parviflora	-	2	Candidate
Penstemon #1 [5]	-	-	Sensitive
Physaria obcordata	-	2	Candidate
Sullivantia purpusii	3C	3C	Sensitive
Thalictrum heliophilum	2 [4]	2	Candidate

[1] Category 2 - Taxa for which information now in the possession of the Service indicates the probable appropriateness of listing as Endangered or Threatened, but for which sufficient information is not presently available to biologically support a proposed rule.

[2] Category 3 - Taxa no longer being considered for listing as Endangered or Threatened. Such taxa are included in one of three sub-categories.

Category 3C - Taxa that have proven to be more abundant or widespread than was previously believed and/or those taxa which are not subject to any identifiable threat at the present.

[3] No present U.S. Fish and Wildlife Service category status, because these species are more locally abundant in other states. These plants are regionally endemic.

[4] Presently being considered by the U.S. Fish and Wildlife Service, Region 6, for Category 2 status.

[5] The #1 is utilized because the material collected is currently being decribed as a new taxon.

WILDLIFE

Introduction

Approximately 365 wildlife species have been recorded or are speculated to inhabit the Piceance Basin either as residents or on a migratory basis (USDI, BLM 1978). This includes 78 mammals, 255 birds, 15 fish, 12 reptiles and 5 amphibians. Only those species that may be significantly impacted or are of major concern are discussed in detail below.

Terrestrial

Big Game

The Piceance Basin mule deer herd is considered to be the largest migratory herd in North America. According to the Colorado Division of Wildlife, populations have fluctuated significantly since the 1950's (15,500 to 70,000) due mainly to severe winters, condition of winter range, and habitat destruction. The herd population is presently increasing since the massive die-off experienced during the winter of 1978 to 1979. The Colorado Division of Wildlife 1981-1982 winter deer population estimate was 28,000. Browse condition on winter range is generally poor, but has improved slightly over the last five years due to the lowered deer population and a corresponding reduction in winter forage use.

Winter range consists of pinyon-juniper and sagebrush vegetation types below 7,400 feet in elevation. Mountain shrub, aspen and Douglas fir types above 7,800 feet in elevation comprise the summer range.

A majority of the deer that winter in the planning area summer on the Flat Tops and Roan Plateau. Fall migration begins during the first two weeks of October with most deer arriving on the winter range by the end of October (Garrott and White 1982). Deer remain on the winter range until spring migration begins in mid-April with most deer arriving back on the summer range during May (Garrott and White 1982). Some mid-winter movement within the basin occurs when deer move onto areas with south facing slopes. Mule deer seasonal ranges and migration routes are shown on Figure II-9.

The elk herd in the Piceance Basin has exhibited a significant increase in population size and occupied range during the last 20 years. The 1982-1983 Colorado Division of Wildlife population estimate indicates that approximately 1,200 elk inhabit the planning area on a year-round basis. Preferred summer ranges are typically above 7,800 feet in elevation in aspen, mountain shrub and Douglas fir vegetation types. Elk seasonal ranges and migration routes are shown on Figure II-10.

Mountain lions are distributed throughout the entire basin preferring areas of dense mountain shrub or pinyon-juniper cover on rocky, rugged terrain. Lions are currently exhibiting a downward population trend with a population estimate of 15 for the area.

Preferred black bear habitat of adequate quality is scarce in the basin. An estimated 10 to 20 bears inhabit the Roan Plateau and Cathedral Bluffs with population trends presently stable.

Small Game and Furbearers

The cottontail rabbit is the dominant small game mammal in the basin and inhabits all vegetation types with highest population densities occurring in greasewood-sagebrush draws. The coyote and bobcat are the most important furbearers based on harvest, monetary value and recreational days provided.

Game Birds and Waterfowl

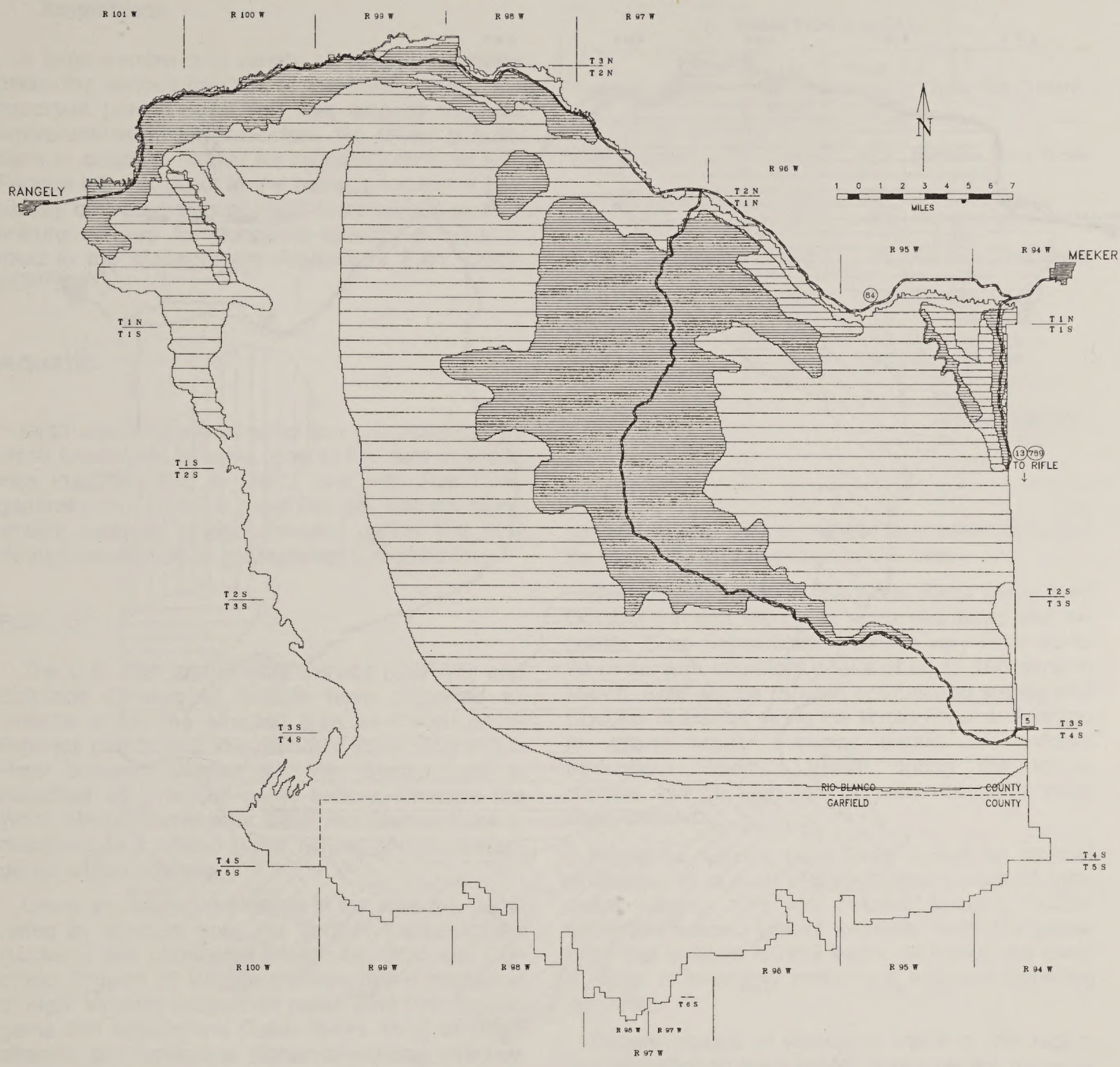
Specific habitat designations and population data for sage grouse in the Piceance Basin are summarized in Krager (1977). Sagebrush density and height are important vegetation factors that influence sage grouse use of an area and habitat quality. Sage grouse winter at lower elevation ranges within the basin and migrate to upper elevations of the Roan Plateau and Cathedral Bluffs for the summer. Sage grouse assemble in flocks on strutting grounds during the March 1 to May 15 breeding season for courtship and mating.

Blue grouse distribution is associated with the occurrence of Douglas fir, the dominant food source during the winter. Summer to early fall habitats are typically in open or semi-open areas along edges of mountain shrub and aspen types where herbaceous vegetation and insects are abundant.

The highest quality waterfowl habitat is associated with wetland habitat along the White River and at Rio Blanco Lake. Secondary use areas are on smaller perennial streams (e.g., Piceance Creek and Black Sulphur Creek) and ponds one-tenth of an acre or larger. Resident and summer breeding populations are low with greatest abundance present during spring and fall migrations.

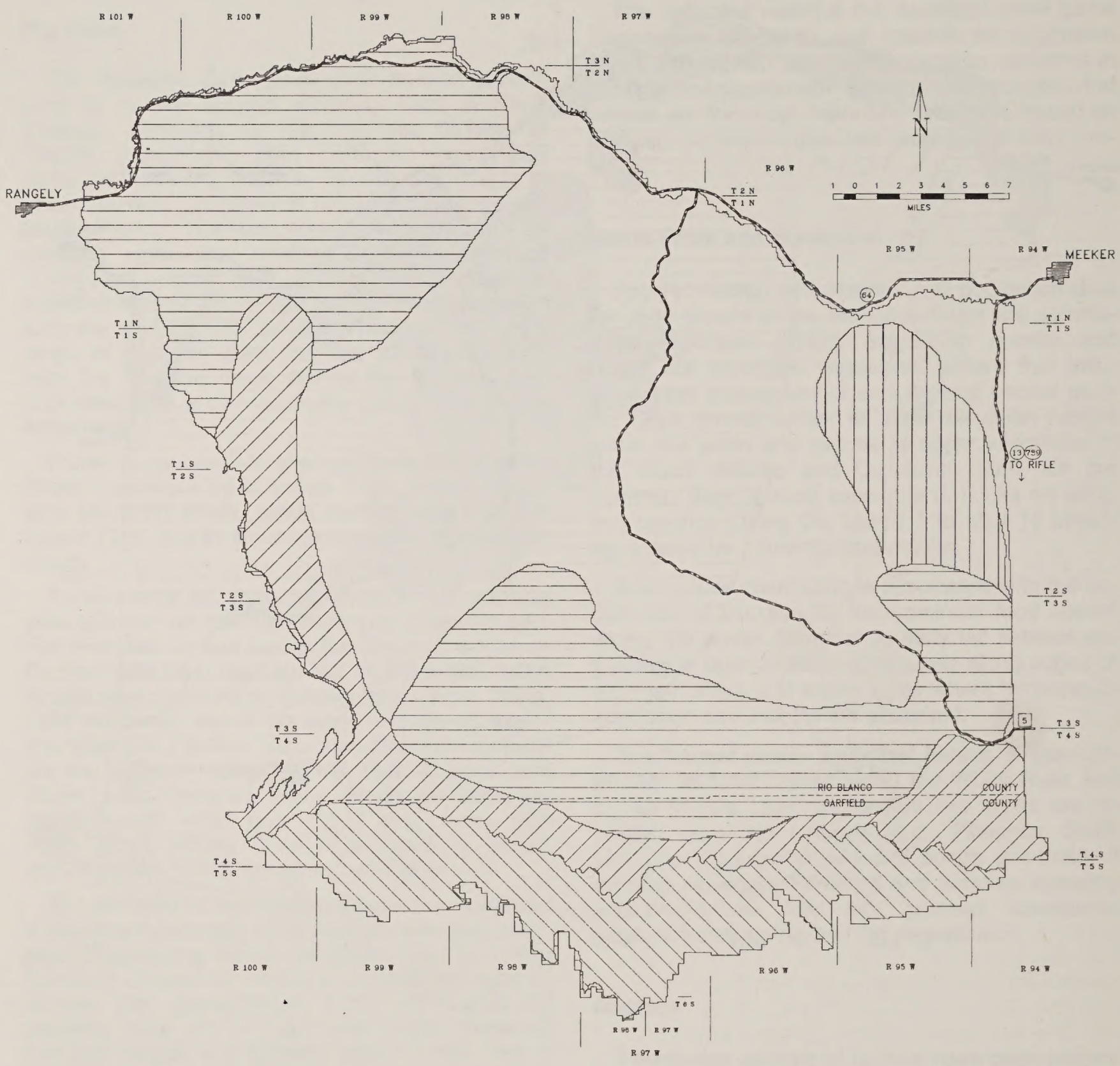
Raptors

Twenty-two species of raptors have been recorded and range from uncommon to common in relative abundance. Approximately 135 nests have been identified in the basin. Preferred habitats are best described by separating raptors into family units: accipiters, buteos, eagles, falcons, owls and harriers. Accipiters inhabit woodlands of pinyon-juniper and Douglas fir. Buteos, eagles and falcons prefer habitat of precipitous cliffs surrounded by open hunting areas of sagebrush, greasewood or sparse stands of pinyon-juniper. Owls are widespread, living in a variety of habitats. Harriers frequent open grasslands usually in proximity to marsh or wetland habitats.



MULE DEER SEASONAL RANGES

Figure II-9



ELK SEASONAL RANGES

Figure II-10

Nongame - Birds, Mammals, Reptiles and Amphibians

A large number and variety of nongame species utilize the various habitats of the basin. These are important prey species and may also be used as environmental quality indicators. No known populations or potential habitat for migratory birds of high Federal interest occur in the basin. Information previously collected through field observations and literature reviews for nongame species is summarized in the Management Framework Plan (USDI, BLM 1981).

Aquatic

Most aquatic environments are characterized as small headwater streams, one to five feet in width, less than two feet in depth, and with flow rates generally less than 0.5 cubic feet per second. Many stream beds lie in highly eroded gullies that flow through sagebrush or greasewood bottomlands.

Fish

The U.S. Fish and Wildlife Service (USFWS) and Colorado Division of Wildlife have classified all streams within the affected area as limited game fisheries potential of low resource value. The White River between Meeker and Rio Blanco Lake is classified as a limited game fishery, whereas the White River downstream from Rio Blanco Lake is classified as a limited game fishery and an endangered species fishery.

Lower elevational drainages in the area are dominated by species from the families *Catastomidae* (suckers) and *Cyprinidae* (minnows). BLM and Colorado Division of Wildlife surveys found segments of eight streams located on public land that support game fish populations (Table II-14). Most of these streams are located at higher elevations and support only marginal populations of small fish due to the small size and flow regimes of these drainages.

TABLE II-14

GAME FISH HABITAT

Stream Name	BLM Stream Miles	Total Stream Miles	Game Fish Present
Piceance Creek	4.5	42.5	Rainbow Trout, Brook Trout
Trappers Creek	6.0	7.0	Cutthrout Trout
Willow Creek	1.0	9.0	Rainbow Trout, Brook Trout
Middle Fork Stewart Creek	5.0	7.0	Rainbow Trout, Brook Trout
Fawn Creek	4.0	7.5	Rainbow Trout
West Fawn Creek	3.5	7.5	Rainbow Trout
Black Sulfur Creek	11.5	19.0	Rainbow Trout
White River	2.1	70.3	Rainbow Trout, Brown Trout, Mountain Whitefish, Channel Catfish, Black Bullhead

Threatened and Endangered Wildlife Species

Six Federally listed species were submitted by the USFWS for analysis in the biological assessment: the bald eagle, peregrine falcon, whooping crane, black-footed ferret, Colorado River squawfish and humpback chub. In addition, the greater sandhill crane and Colorado River cutthroat trout, two state listed endangered species, will be addressed. No critical habitat has been identified for Federally listed species in the basin.

Bald eagles reside in the White River valley from October through March as winter residents and migrants. Core populations in winter vary from 50 to 70 birds, with migratory peaks of up to 160 birds in March. Bald eagles roost in cottonwood stands and Douglas fir stands along the White River and forage in upland areas. Foraging eagles are evident throughout Piceance Basin during the winter months, but no high use or preferred areas have been defined.

Peregrine falcons have been noted on several occasions in or near Piceance Basin. Lack of adequate nesting cliffs and suitable foraging habitat within the basin's interior severely limits the possibility that suitable habitat exists. Sightings are likely a factor of migratory movement and post-breeding dispersal.

Recent reports of whooping crane in this region are attributed to the USFWS foster parent recovery program, since all observations have involved the accompaniment of greater sandhill cranes. Whooping and sandhill crane use of Piceance Basin is considered incidental, migration-related stopover because: 1) preferred crane habitat is severely limited in extent and quality in the Piceance Basin, 2) all sightings are made concurrently with seasons of migratory movement, and 3) observations involve cranes in flight or ground use of short duration.

No recent or historic evidence exists which indicates occupation of the basin by black-footed ferrets. In this region, white-tailed prairie dogs are considered to be their primary prey and known ferret distribution closely coincides with that of prai-

rie dog towns. Gilbert (1977) identified three towns, totaling 121 acres in the northwest corner of the basin along Highway 64.

It has been regularly documented that Colorado River squawfish occur in the White River. The Colorado segment of the White River is considered to be habitat for juvenile and adult squawfish. The apparent importance of the White River to fish in the Upper Colorado River Basin is the quantity and periodicity of water flow.

There is one report of a humpback chub from the White River (Sigler and Miller 1963). However, the Colorado River Fishes Investigation Team, established in April 1979, have not found recent evidence of this species inhabiting the White River.

Trappers Creek supports a viable population of Colorado River cutthroat trout and is considered essential habitat by the Colorado Division of Wildlife. Behnke (1976) analyzed samples from this creek and identified them to be relatively pure specimens. Resampling in 1981 revealed some hybrid influence with rainbow trout and were assigned a purity grade of C which indicates that they are a good representation of Colorado River cutthroat stock, but exhibit some evidence of hybridization.

Federal and state regulations require management of areas inhabited by threatened or endangered wildlife species. This management may limit or constrain development of other resources. Projects with the potential for impacting water quality or quantity of the White River and Trapper Creek may be restricted. Restrictions would also be enforced on any project along the White River that would adversely impact bald eagle habitat or bald eagle use of this habitat.

Important Habitat Features

Water is an essential habitat feature for wildlife due to its limited availability and distribution in this arid region.

Table II-15 summarizes important habitat features for wildlife species of primary concern.

TABLE II-15

IMPORTANT HABITAT FEATURES

Species	Habitat Features
Mule deer	Severe Winter Range Winter Concentration Areas
Elk	Summer Range
Mountain lion	Winter Concentration Areas
Sage Grouse	Winter Range Brood Habitat Strutting Grounds (Leks) Nesting Habitat (*≤2 miles from lek)*
Raptors	Nesting Habitat (includes nest sites and feeding areas)
Colorado River Squawfish, Humpback Chub	White River
Bald Eagles	Wintering Areas Concentration Areas
Colorado River Cutthroat Trout	Trappers Creek
All	Water

TABLE II-15—Continued

IMPORTANT HABITAT FEATURES

WILD HORSES

The wild horse range in the planning area encompasses 249,183 acres in the northwestern portion of the Piceance Basin. The 1983 wild horse population was estimated to be 274 head.

Interviews with local residents of the Meeker area indicate that wild horse herds were here when the first settlers arrived in 1882. Many early ranchers released high quality studs into the wild herds that roamed the area. This practice was intended to upgrade wild horses for use in ranch work and for market. During the depression years, many small ranches and homesteads were abandoned. Domestic horses that were left behind were absorbed into wild horse herds, increasing their number and adding new genetic material to the wild horse population.

The Piceance Basin wild horse herd was initially counted in August 1975 and numbered approximately 143 head. The current population of 274 is based on a February 1981 aerial count with a 15 percent adjustment for the annual population increase. These horses are distributed in ten livestock allotments within the planning area.

Movement of wild horses within their range is influenced greatly by existing fences. Although horses have become accustomed to the fences, the fences remain a barrier to their free-roaming nature. Wild horses move between allotments that do not have complete boundary fences. Horse migration over the Cathedral Bluffs has been observed, allowing for the possibility of breeding be-

tween the Douglas Creek herd and the Piceance Basin herd.

Seasonal factors also influence horse movement and areas of concentration within the wild horse range. During periods of deep snow cover, horses concentrate on windswept ridges and southern exposures where forage is more readily available. During summer and early fall, wild horses are forced to concentrate around perennial water sources as intermittent waters dry up. The most important water sources in the Piceance Basin wild horse range are Yellow Creek, Stake Springs, Boxelder Creek, Corral Gulch, Duck Creek and Spring Creek. There are also approximately 19 developed springs, 10 undeveloped springs feasible for development and 37 reservoirs in the horse range.

Wild horses compete with livestock, elk and a large herd of mule deer for forage. In addition, disturbances associated with natural gas and oil shale development have rapidly increased within the wild horse range within the past few years. Increased energy development and the increased forage requirements for wild horses have resulted in an expansion of the wild horse range. Presently, wild horses occur in areas beyond the recognized wild horse range (those areas utilized by wild horses at the passage of the Wild and Free-Roaming Horse and Burro Act of 1971).

CULTURAL RESOURCES

The cultural resources in the planning area represent a full chronology of habitation dates in surface as well as subsurface deposits. This is beneficial when using data accumulated to reconstruct prehistoric and historic lifeways. Cultural resources must be evaluated in terms of their potential to contribute information to a large data base and, thus, prove useful in answering research questions designed to explain the origins and history of man in northwestern Colorado.

To date, approximately 77,529.5 acres or 9.6 percent of the planning area has been inventoried at the Class III level for cultural resources. Based on a ratio of one site per 122 acres (BLM survey data on file in the White River Resource Area office), there could be approximately 6,605 sites in the Piceance Basin Planning Area. The cultural resource inventory has been stimulated by the intensive energy-related activity in the planning area. Consequently, most survey work has been done on a project-specific basis and not as a result of a scentific research design. The exception to this is the survey work which was done by Gilbert/Commonwealth (Newkirk and Roper 1983) to field test their predictive model. The sampling design which was used to test the model is a stratified proportional random sample, with sampling strata defined by major drainage systems. No additional inventory was done for the preparation of this RMP. All data was taken from previous work done mostly in a support capacity for energy development and range improvement projects.

Table II-16 summarizes the types of cultural sites that are found in northwest Colorado and which may occur in the planning area.

TABLE II-16

CULTURAL RESOURCE SITE TYPES

Function/Kind	Characteristics	Traditions
Lithic scatter (open lithic; chipping; chipping station)	Areas where the waste from the manufacture of stone tools or the tools themselves are found.	All
Campsite (habitation; camp; burnt spots; fire pots; hearths)	A lithic scatter with the addition of features connected with fire making; charcoal, ash fire cracked artifacts, fire cracked rocks, or burnt bone, groundstone and/or pottery.	All
Quarry (chippings; manufacturing areas)	An area containing a natural source of rocks suitable for making tools. Unmodified rock, waste, and tools in all stages of manufacture are found.	All
Kill site (trap; jump)	An area containing stone and/or bone tools in association with the remains of one or more animals.	All, but particularly Llano and Plano
Rock shelter (cave; overhang)	An area protected from the weather by an overhanging rock formation. Usually has a drip line. May or may not have surface material culture.	Plano, Archaic, Fremont, Protohistoric
Rock art (petrograph) (a) pictograph (b) petroglyph	Any artistic expression or message on a rock surface. (a) Painted figures of people, animals, plants, letters, numbers or abstracts. (b) Incised figures of people, animals, plants, letters, numbers or abstracts.	Possibly Archaic, Fremont, Protohistoric, Historic
Burial	Remains of human beings, fragmentary or whole.	Fremont, Protohistoric/Historic

TABLE II-16—Continued

CULTURAL RESOURCE SITE TYPES

Function/Kind	Characteristics	Traditions
Tipi rings (stone rings, tipis)	Circular arrangement of spaced rocks, 3 to 15 m in diameter.	Protohistoric/Historic
Wickiups (tipi poles)	Poles or branches of pinyon or juniper laid up against living trees. Interior floored with juniper bark.	Protohistoric/Historic
Granary (cist, corn crib)	Mud-mortared sandstone slab structures, usually about 1.5 x 1.5 x 1.5 m. Most often built into sandstone ledges, sometimes mud lined and capped or lidded with a large slab.	Fremont
Rock walls (forts)	Alignments or walls of mud-mortared or dry-laid stone masonry. May be single or multiple. May have "doorway", usually build on ridge.	Fremont
Corrals/horse traps	Enclosure, usually of log or wood construction, with a single entrance. May have "wings" built onto entrance.	Protohistoric/Historic
Sweat Lodge	Conical shaped, free standing structure of brush and poles with a large pile of fire-cracked rock immediately in front of opening to structure.	Protohistoric
Homestead	One or more structures of varied size, shape and materials used to shelter isolated Euro-American families claiming land under various homestead laws.	Historic

Similar kinds of sites from the same general time period are given a type name and are assigned to a named tradition. In northwestern Colorado, the most common traditions are the Llano, Plano, Archaic, Fremont, Protohistoric and Historic (see Table II-17).

TABLE II-17

CULTURAL TRADITIONS

Time	Tradition
1776-50 years ago	Historic; Ute
c. 1250-1776	Protohistoric
c. 900-1250	Fremont
c. 2500 BC-AD 900	Archaic
c. 7000 BC-2500 BC	Plano
c. 10,000 BC-7000 BC	Llano

Prehistoric

Northwestern Colorado has been occupied by humans for at least 11,000 years. While the humans remained very similar physically, their environment and food sources changed slowly through time, bringing about changes in the behavior of the people involved. These changes were reflected in the debris which they left behind and which has been preserved through time. From this patterned, as opposed to random, distribution and its changes through time, a shadowy and incomplete picture of these people's lifeway can be built up. Data can be retrieved on what natural resources were available and utilized, how many people utilized them, and how they were used. Some data may be gained through archaeological research on what distributions and ranges certain animals and plants had in the past and what the past climate was like for comparison with current data.

The Gilbert/Commonwealth predictive model for the Piceance Basin (Newkirk and Roper 1983) was generated from data that resulted from the location of 380 sites and isolated finds which were recorded during six major surveys conducted between 1973 and 1980 (Gordon and Kranzush 1978, Grand River Institute 1980, Jennings and Spitzer 1976, Weber et al 1977, Price 1978, and Hurlbett 1976). The predictive model was originally intended to provide cultural resource data for the prototype oil shale planning effort. Therefore, only the area which was being analyzed for additional oil shale tracts was considered in the modeling process. The model is not suitable for application on a planning area-wide basis. It will, however, be utilized during the site-specific analysis after oil shale tracts are delineated. The model is suitable for prehistoric sites only.

Based on the portion of the planning area which was used as the study area for model generation, it was concluded that the following relations exist between site densities and environmental zones:

1) Topographic zone, i.e. ridgetop vs. valley bottom is not an important predictor of site location.

2) Stream rank is a predictor; specifically, site density tends to be higher further up stream rather than along major streams.

3) Vegetation zone is also predictive. Site density appears higher in the pinyon-juniper and rabbitbrush-sagebrush zones.

4) Relief is also predictive; sites more frequently occur where relief is relatively low.

5) Exposure is predictive; sites with southerly exposures are most likely to occur.

6) Soil is not a particularly useful variable. That sites occur mostly on only a few soil types is probably more reflective of the correlations between soil types and vegetation than of selection for soils.

These factors are expected to be similar in other parts of the planning area but, to date, no work has been done to corroborate this theory.

Historic

The Piceance Basin's history has been described in *An Isolated Empire: A History of Northwestern Colorado* (Athearn 1981), which is a Class I (literature search) inventory for the Craig District. Additionally, a supplemental Class I (History) inventory was prepared (Baldwin 1981) in which site summaries are provided to enhance the Class I narrative. These documents, along with Class III inventory, represent the present extent of inventory for historic sites in the planning area.

The first record of Europeans in this region dates from 1776 when the Dominguez-Escalante expedition passed along Douglas Creek on its way into Utah. From then until 1879, there was little interest in the Piceance Basin which was inhabited by Ute natives. In September 1879, Utes from the White River Reservation rose in rebellion, killing agent Nathan Meeker, and subsequently ambushing a rescue force commanded by Thomas T. Thornburgh. The result was that the Utes were forcibly removed from western Colorado and this portion of the state was opened to settlement.

The Piceance Basin was, at first, used for homesteading and livestock grazing. Since the land was broken and not well suited to agricultural uses, except along the bottomlands, cattle grazing and later sheepherding became the primary economy of the basin. This remains the case today. Physical evidence of these events includes log cabins, homesteads, ranches, corrals, cemetaries, school houses and other historic features. Additionally, horse traps are frequently found, indicating that wild horses were rounded up on a regular basis. Building types vary from large log cabins/houses to dugouts. Other settlement indicators include townsites like White River City. These manifestations of Euro-American development date from the late 19th century to about 1935.

The World War I era saw considerable development of oil shale in the Piceance Basin. This is reflected in what is thought to be an early oil shale retort and adit near Rio Blanco. This type of site dates from at least 1915 and there is a good chance that more historic oil shale processing sites may be identified.

Other physical evidence of Euro-American occupation includes the traces of a stage road from Rio Blanco to White River City, several survey cairns, sheep and cow campsites and one "religious" site attributed to local sheepherders. Thirty-four historic sites have been recorded to the present based on limited historic resource inventory conducted since 1972. Of these, 17 are located on BLM managed lands, 11 are on state lands, five are on private lands and one is on Department of Energy controlled land. The predominate site type in the planning area is cabins (17), followed by horse traps and corrals (8), with one each for all other types of sites except cemetaries and schools (2 each). This historic resource review indicates the range of sites and the settlement patterns throughout the Piceance Basin.

National Register

The Duck Creek Wickiup Village (5RB53) is the only cultural site within the planning area which is currently listed on the National Register of Historic Places. A fence was constructed in 1976 to protect the site from livestock damage and an interpretive sign was installed. At this time, no sites have been nominated or formally determined to be eligible to the National Register. Approximately 35 sites have been field evaluated as eligible or likely to be eligible but none of these assessments have been confirmed by the BLM.

Limiting Factors

Mandatory protection of National Register sites requires Section 106 consultation with the State Historic Preservation Officer and the Advisory Council on Historic Preservation to develop a suitable mitigation plan to ameliorate adverse impacts on listed or eligible sites. The consultation process could create a delay or necessitate relocation of proposed surface-disturbing projects. This would most likely affect energy development or range improvement projects. In most circumstances, avoidance of the site is the preferred mitigation method.

PALEONTOLOGICAL RESOURCES

A comprehensive paleontological inventory has not yet been completed in the planning area. However, several formations within the planning area, Morrison, Wasatch and Green River, have historically been known to contain significant fossils. Significant fossils are those which make a substantial contribution to scientific knowledge. In addition, site specific inventories have indicated the Williams Fork Formation of the Mesaverde Group may also yield significant vertebrate fossils, but further study is needed before the formation can be considered paleontologically significant. Table II-18 illustrates all of the fossiliferous formations of the planning area. For more detailed information concerning the formations the reader is referred to a study conducted by Lucas and Kihm entitled *Paleontological Resources Study and Inventory of Part of the White River Resource Area, Piceance Creek Basin, NW Colorado* (December 1982).

TABLE II-18

FOSSILIFEROUS FORMATIONS IN THE STUDY REGION

ERA	Periods and System	Epochs and Series	Formation	Environment	Common Fossils Present
Cenozoic	Tertiary	Eocene	Bridger Formation	Fluvial	Vertebrate Fossils
			Green River Formation	Fluvial Lacustrine	Vertebrate Fossils Fossil Fish; Fossil Leaves & Insects. Fresh Water Gastropods and Pelecypods
		Paleocene and Eocene	Wasatch Formation	Fluvial and Lacustrine	Vertebrate Fossils, mammals. Some Ostracodes and Gastropods. Fossil leaves, genus Aralia
		Paleocene	Fort Union Formation	Fluvial in Part of Swamps and Marshes	Vertebrate fossils, fossil leaves
			Ohio Creek Formation	Fluvial	Non Fossiliferous
	Cretaceous	Upper Cretaceous	Mesaverde Group/ Williams Fork Formation	Fluvial in Part Swamps Litterol Some Marine Shales	Vertebrate fossils, mammals and dinosaur. Fossil Plants from Genera Picus, Myrica, Eriocaulon, & Salix. Fossil leaves in coal. Ammonities & Inoceramus Clams in Marine Shales. Pelecypods, Gastropods
			Mesaverde Group/Iles Formation	Fluvial in Part Swamps Litterol Some Marine Shales	Pelecypods, Fossil leaves in the coal Ammonities & Inoceramus Clams in Marine Shales- Fossil Plants of Genera Ficus & Halymenites.
			Mancos Shale	Marine Off-shore	Ammonites-Baculites Scaphites, Inoceramus Clams, Pelecypods, Cephalopods
			Frontier Sandstone	Marine Brackish Water	Pelecypods, Shark Teeth, and Plant Fossils

TABLE II-18—Continued

FOSSILIFEROUS FORMATIONS IN THE STUDY REGION

ERA	Periods and System	Epochs and Series	Formation	Environment	Common Fossils Present
Mesozoic		Lower Cretaceous	Mowry Shale Member of Mancos	Marine Off-shore	Carbonized wood, Cyclord Fish Scales, Fish Bones
			Dakota Sandstone	Fluvial, Marshes and Swamps	Silicified Wood, Ferns Dinosaur, Mollusk
	Jurrassic	Upper Jurassic	Morrison	Lake, Stream Floodplain & possibly delta deposits	Abundant dinosaur fossils
		Middle Jurassic	Curtis		Marine Pelecypods, Gastropods and Cephalopods
			Entrada		Non fossiliferous
			Carmel		Fossils uncommon
		Lower Jurassic	Navajo	Eolian, basal layers waterlain	Dinosaur tracts
	Triassic	Upper Triassic	Chinle		Silicified wood. Phytosaur teeth and bone fragments. Amphibian bones.
		Lower Triassic	Chinarump		Silicified wood common
			Moenkopi		Reptilian tracks
Paleozoic		Permian	Park City		Gastropods & Pelecypods
			Weber		Unfossiliferous
		Pennsylvania	Morgan		Brachiopoids, Corals, Bryozoa & Forominifera
		Mississippian	Madison		Occassional fossiliferous layers. Corals Brachiopods and Trilobites.
		Cambrian	Lodore		Frequently fossilerous. Trilobites, Brachiopods and Gastropods

RECREATION

Within the Piceance Basin Planning Area, opportunities for recreation are varied. These recreation opportunities are classified according to (1) the types of experiences that can be achieved from participation (2) in a variety of activities (3) within different environmental settings. The primary determinant of these recreation opportunity classes is the setting. It describes the overall environment in which the recreation occurs, influences specific types of activities that can occur, and ultimately determines the resulting types of experiences that users can achieve. The setting is formulated using a number of factors such as remoteness, size, amount of landscape alteration or development, the number of recreation users and their noticeability, and management constraints.

Six broad types or classes of recreation opportunities have been recognized on a continuum or spectrum ranging from largely natural and low use areas to highly developed and intensively used

areas. These classes are named and briefly described as follows:

Primitive (P): Areas lying more than three miles from the nearest point of motor vehicle access, having unmodified landscapes, where there is little evidence of other people, and that are almost completely free of management controls. (None in planning area.)

Semi-Primitive Non-Motorized (SPNM): Areas at least one-half mile from the nearest point of motor vehicle access but not as distant as three miles, having mostly natural landscapes, where there is some evidence of other people, and where there are very few management controls. (None in planning area.)

Semi-Primitive Motorized (SPM): Areas alongside or near four-wheel drive roads and trails, having mostly natural landscapes, where there are often evidences of other people but numbers seen remain low, and where management controls are evident but not dominant.

Roaded Natural (RN): Areas alongside or near improved roads where pickups and sedans can be driven, having naturally appearing but modified landscapes, where there are moderate evidences and numbers of other people, and where management controls provide a sense of security.

Rural (R): Areas alongside or near paved highways, or having heavily modified landscapes, where there may be considerable evidences or numbers of other people, and where management controls are easily seen.

Modern Urban (MU): Areas alongside or near paved highways, or where the natural landscape is dominated or replaced by man-made developments, where there are great numbers or evidences of other people, and where management controls are numerous and dominant.

These class names merely suggest the kinds of recreation opportunities common to each type of area, but they are not completely descriptive by themselves. For example, the title "Semi-Primitive Motorized" does not mean that areas so classified are necessarily utilized by off-road vehicles, though they may be. Instead, this classification simply describes areas that contain primitive motor vehicle access routes and where numbers of public users are low and dispersed.

A recreation opportunity setting (ROS) analysis was completed for the Piceance Basin in 1983 (see ROS map, Figure II-11).

Table II-19, summarizing the existing recreation opportunity, was developed as a baseline from which to compare possible future management actions in the Piceance Basin.

TABLE II-19

RECREATION OPPORTUNITY CLASSES PERCENT/ACRES

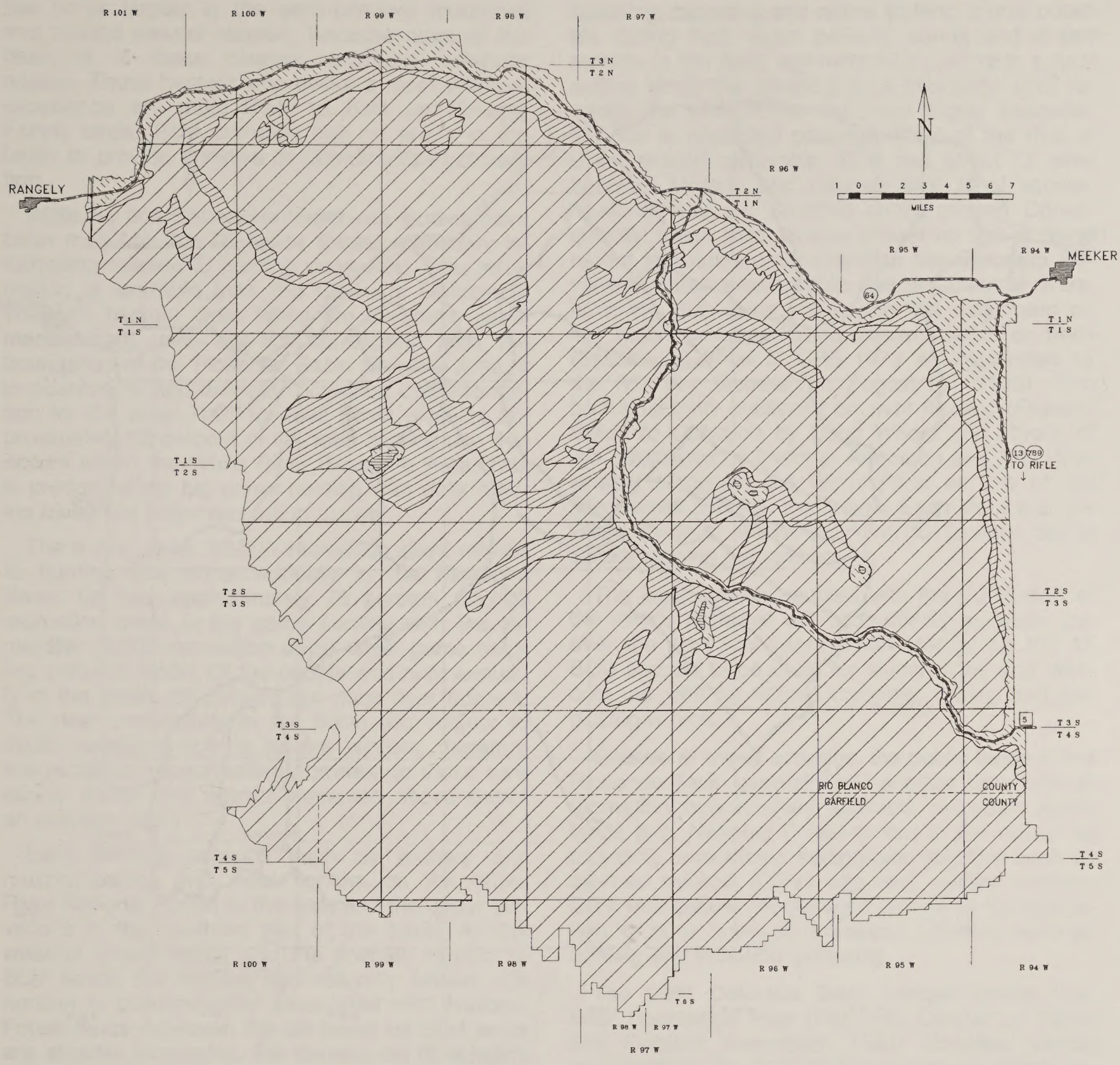
Recreation Opportunity Class:	P	SPNM	SPM	RN	R	MU
BLM	0/0	0/0	82.6/499,453	13.8/83,387	3.5/21,070	0.1/518
All	0/0	0/0	80.6/650,183	12.4/99,780	6.9/55,562	0.1/765

There are no primitive or semi-primitive non-motorized recreation opportunities in the Piceance Basin at the present time. This is primarily due to the great number of roads and trails that provide motorized access throughout the basin.

Any given recreation activity can occur in more than one of these four existing opportunity classes, but it will differ according to the constraining nature of the setting in which it occurs (e.g. camping away from vehicles or backcountry camping vs. camping near vehicles). Consequently, the kinds of experiences that people get from these activities will also be different.

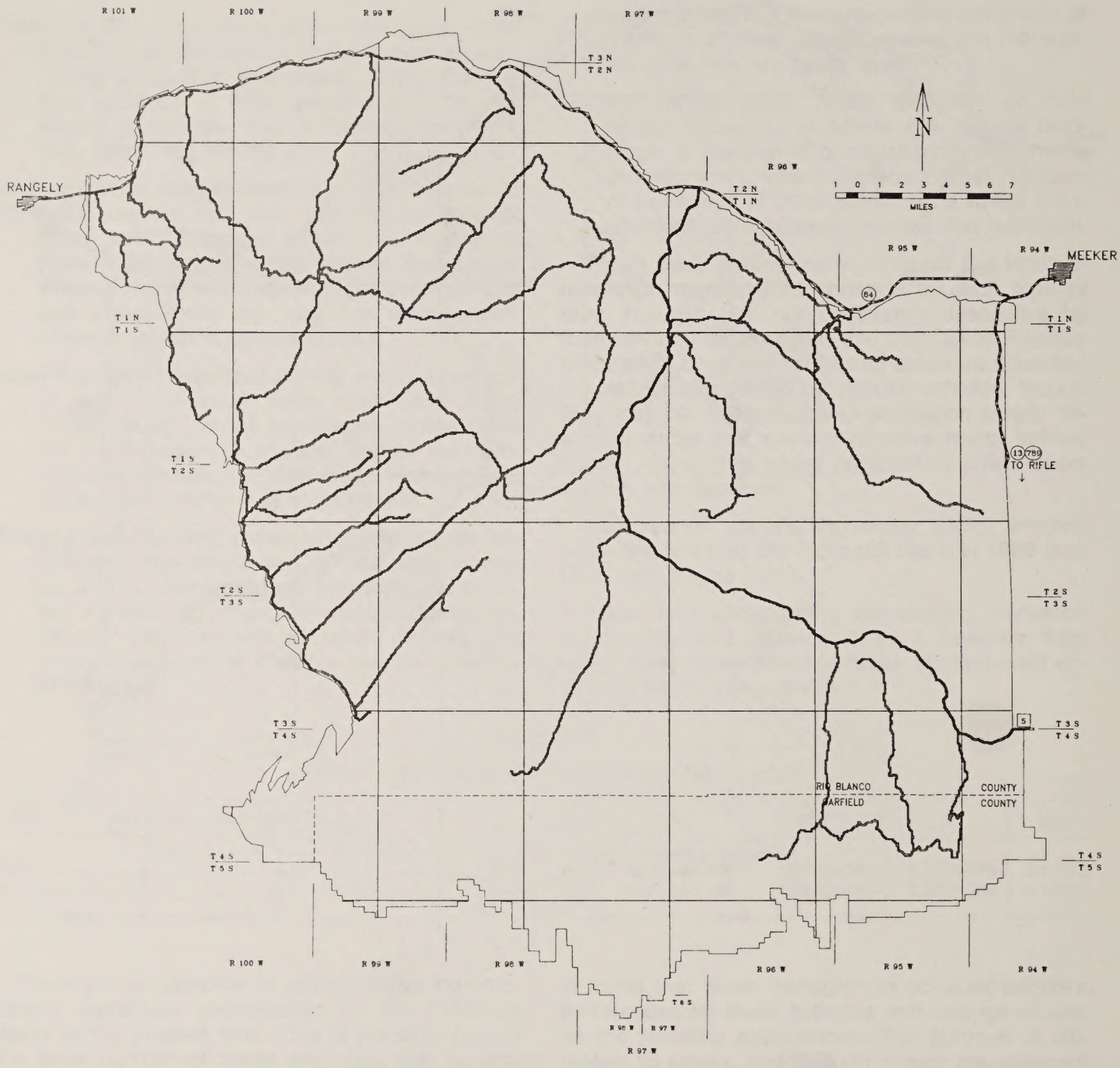
BLM's resource management actions affect both the types of available activities and settings. This classification framework provides a basis for evaluating the effect of these actions on recreation users in terms that allow managers to consider people's preferences for these activities and settings as well as the resulting experiences. The purpose is ultimately to ensure that through proper management of the resource settings, and the activities available within each, BLM can ensure that opportunities for people to achieve their most satisfying recreation experiences in the Piceance Basin are provided and maintained.

Hunting, primarily big game, is by far the dominant recreation activity occurring on the public lands in the Piceance Basin. Camping occurs as a spinoff activity within the hunting areas. It is estimated that there may be up to 20,000 camping days spent in the basin during hunting season. Figure II-12 shows the concentration areas for camping, although much is dispersed. Both activi-



RECREATION OPPORTUNITY SPECTRUM

Figure II-11



Camp Concentrations

CAMPING CONCENTRATION AREAS

Figure II-12

ties occur largely in the semi-primitive motorized and roaded natural classes, because most of the basin is in these classes, providing vehicular access. Those hunters who desire a more primitive experience are most likely to hunt on National Forest lands. BLM currently has no areas in the basin to provide primitive or non-motorized recreation.

While no comprehensive visitor-use studies have been made for the Piceance Basin, secondary information relating to hunting does exist. This information is available from the Colorado Division of Wildlife's harvest data. While the Division's game management units do not correspond with the boundaries of the Piceance Basin Planning Area, it is possible to approximate recreation use information for the area. The Piceance Basin receives approximately 52 percent of the total hunting use that occurs within the White River Resource Area. This is predominately big game hunting with deer hunting by far the major recreation activity.

There are some 33,000 recreation days related to hunting that occur annually in the Piceance Basin. Of this, approximately 75 percent (25,000 recreation days) is big game hunting with the remainder (8,000 recreation days) small game hunting, primarily rabbit. Of the people who hunt annually in the basin, 60 percent are mule deer hunters. The deer populations in the basin are subject to cyclic variations due to severe winters; therefore the recreation opportunities correlate to these variations. (Note: The figures presented above depict an average year.)

Early hunting seasons such as archery and muzzle loading find most hunters on the White River National Forest to the east and the upper elevations in the southern part of the basin. As the weather grows colder and the animals migrate to BLM lands, the hunting use naturally follows. Elk hunting is predominantly associated with National Forest lands; however, the elk herds on BLM lands are steadily increasing. Elk hunting on BLM lands occurs in the southern most part of the planning area, along the Roan Divide and Cathedral Bluffs. This is in the semi-primitive motorized ROS class primarily. Mule deer and smaller game hunting occurs throughout the basin in the semi-primitive motorized and roaded natural classes.

Of the total number of big game hunters using public lands in the basin, over half are from out-of-state. California and Texas dominate the out-of-staters. Of the in-state hunters, 8 percent are local (Rio Blanco County), 42 percent are from the Denver metro area and 50 percent are from other areas in the state.

The White River, which forms the northern boundary of the planning area, is suitable for kayaking, canoeing and rafting (rafting is only possible during high water periods, spring and a few months in the early summer). The river is in a rural setting along the planning area boundary. Until recently, the White River has been largely inaccessible due to restricted passage. Most of the river is under private ownership. BLM has about 15 sites between Meeker and Rangely with legal access, however none are identified on the ground. Consequently, these sites receive almost no use at all. A recent legislative amendment to the Colorado Revised statutes allows public use of Colorado rivers, providing that users utilize only the water and do not touch privately-owned stream banks or beds (Section 18-4-504 5, CR5 1973 as interpreted by the Attorney General on August 31, 1983). Two books recently published on river floating (*Floaters Guide to Colorado* by Doug Wheat and *Rivers of the Southwest* by Fletcher Anderson and Ann Hopkinson) recognize the White River as one of the finest small rivers in the region. Each state that the White River is almost unknown to floaters, but is quickly gaining recognition.

The legal opinion coupled with the publication of the river's potential will undoubtedly increase use over the next few years. The potential for the 15 BLM parcels to be used for launch sites and take-outs, as well as related camping, fishing and picnicking is high.

Outside of these activities, the public lands in the Piceance Basin generally add another dimension to recreation opportunities available on other public lands (e.g. National Forest lands) in the region by providing unrestricted settings for activities such as off-road vehicle (ORV) use and wildlife viewing. ORV use occurs mostly as a means of transportation for other types of recreation activities, such as hunting and firewood gathering.

The 1981 Colorado State Comprehensive Outdoor Recreation Plan (Colorado Division of Parks and Outdoor Recreation 1981) identifies priority management for BLM in the region (of which the Piceance Basin is a part) as best encouraging nature study, camping, ORV use and picnicking. BLM now provides opportunity for each of these, although not in a formal manner with developed facilities. These opportunities occur in a variety of motorized ROS classes.

VISUAL RESOURCES

The Piceance Basin has a highly dissected landscape dominated by an interior plateau with relief diminishing from south to north. The vegetation is

predominately pinyon-juniper (see Topography and Vegetation sections).

An inventory of the visual resources in the basin was conducted in 1978. One of the elements evaluated was the overall scenic quality of the area. Scenic quality relates to the inherent scenic values of the landscape and can perhaps be best described as the overall impression retained after driving or walking through an area. The basin was quantitatively rated on seven key factors: land form, vegetation, water, color, influence of adjacent scenery, scarcity and cultural modification. Ratings are based on relative comparision to similar landscapes of the Colorado Plateau physiographic province, an area which covers western Colorado, northwest New Mexico, northern Arizona, and the southeast half of Utah. The values for each category are calculated and, according to total points, three scenic quality classes are determined and mapped:

Class A - Areas that combine the most outstanding characteristics of each rating factor.

Class B - Areas in which there is a combination of some outstanding features and some that are fairly common to the physiographic region.

Class C - Areas in which the features are fairly common to the physiographic region.

The acreage identified in each class is presented in Table II-20.

See Figure II-13 for the location of these classes in the planning area.

TABLE II-20

SCENIC QUALITY RATING

Piceance Basin Planning Area

Scenic Quality Class	Acres	Percentage of Planning Area
A	4,766	0.59
B	442,187	54.87
C	258,947	44.54
Total	805,900	100.00

WILDERNESS

In Section 603 of the Federal Land Policy and Management Act (FLPMA) of 1976, BLM was directed to review all roadless areas of 5,000 acres or more for their wilderness potential. The process was initiated in 1978 with the wilderness inventory. This inventory, which was completed in November 1980, did not identify any Wilderness Study Areas (WSAs) in the Piceance Basin, so all public lands in the planning area have been released from further wilderness consideration under provisions of Section 603.

Since there are no existing or potential wilderness areas within or immediately adjacent to the planning area, wilderness will not be discussed as a separate resource further in this plan. Air quality (including visibility and its relationship to existing wilderness areas in the region) is addressed in the Air Quality section.

SOCIAL

Few persons live in the Piceance Basin Planning Area - mostly ranch families scattered along its northern and eastern borders in the White River valley and the Highway 13 corridor. About a dozen ranches lie along Piceance Creek which cuts diagonally across the northeastern part, and up two side valleys (some housing more than one family). A few ranches on the White River have been sold to energy companies and grazing rights leased by local ranchers.

Two other principal human activities occur in Piceance Basin itself: seasonal big game hunting, and oil shale and minerals development.

Politically and socially, ranchers in this region of Colorado have traditionally held dominance beyond their proportionate numbers, a strength that has waned since the latest energy boom began in the 1970's.

Hunting, while seasonal, has long-time social importance, both as a source of valued recreation by local citizens, and as a source of economic benefits. At least some Meeker citizens apparently have chosen to live here because of the outstanding hunting and fishing opportunities. Local lifestyles depend to some extent upon Piceance Basin game.

Common in such settings are conflicts between hunters and ranchers because some hunters are careless of the property and stock of ranchers, and some ranchers restrict vehicle access. Likewise, hunters and ranchers are sometimes in conflict with mining interests while various mining and oil shale interests are negatively competitive with each other.

Of the communities near the boundaries of the planning area, Meeker, Rangely and Rifle are most



SCENIC QUALITY CLASSES

Figure II-13

likely to be socially affected by BLM decisions and actions. All communities mentioned in this discussion are shown in Figure II-1.

Meeker

Meeker traditionally was a scenically located, small, isolated ranching community with a hunting-fishing tourist trade in fall and summer. But it, like Rifle, has lived in the shadow of energy development for 80 years. Only after 1975 did the activity seem certain enough to erode the skepticism of lost expectations from the past.

By about 1980, a general spirit of either resignation to, or active acceptance of, energy growth was beginning to prevail. Local and county governments were developing a more formal structure to provide for growth management. Professional planners were hired, and Oil Shale Trust Fund and other impact monies were obtained for expanding facilities and services.

An advisory group of local leaders, business, government, industry and human service representatives was formed. A new Human Resources Council coordinates social services planning, and identifies needs. A recreation survey was made, and a plan is being implemented.

Additional housing of various price ranges was built at a rapid pace; social services, such as mental health, aid for the handicapped, and a branch of Colorado Northwest Community College, were all being added or expanded. Some conflicts among interest groups and competition for funding have, of course, been inevitable.

Boom conditions have slowed, perhaps reversed, in Meeker since 1981. Leaders now have concern for surplus housing, unemployment, and other "bust" problems, at least for the short-term. While there is optimism that oil shale operations will resume at C-a and C-b tracts eventually, and that local coal markets will improve in a few years, prospects for immediate energy turnaround are dim, and Meeker faces at least some period of stability or decline.

A 1981-1982 on-going study of social impacts to Meeker (Lillydahl et al 1982) indicates that the people continue to treasure their beautiful natural environment with its clean air and clean water. Further details on this longitudinal community-wide study are given in Appendix A.

Thus, Meeker was in a boom growth pattern for several years but is currently in a slump which, if it ends within a reasonable time (two or three years), will have given the community the breathing spell necessary to catch up sociologically with the changes that have occurred, and thus will have been beneficial.

Rangely

Rangely is more isolated, less scenic, more arid, and has a very different historical setting than Meeker. Distance from other Colorado towns has caused it to orient more to the Vernal, Utah area.

Rangely's population jumped from 100 or so to 5,000 during the oil and gas boom of World War II. Rangely is thus a younger town than Meeker. It has always been an energy town. The drier climate supports less ranching and little tourism, so its traditions did not grow out of the usual ranching society of northwest Colorado. It had previously struggled to retain its population, and both prepared for and welcomed energy development during the late 1970's when energy independence became a national priority.

Among Rangely's preparations for growth was the creation of a Recreation District that obtained financing for the most complete recreation facility in the region. Colorado Northwest Community College provides a technical program geared specifically to energy production and the hospital and schools have low occupancy rates and can absorb considerable growth. Planning, zoning, and stipulations for front-end financing, of the Moon Lake Power Project (which includes the Deseret Power Plant 35 miles west of Rangely, in Bonanza, Utah, and the Western Fuels coal mine that will supply the power plant, just east of Rangely), have made possible further social and economic impact mitigations. Housing and lands available for development continue to be in short supply, but a recent purchase of land from BLM makes possible further expansion of the community.

The formalization of political, planning and other government processes has been occurring in Rangely for several years, through increasing use of professionally trained personnel. A diversification of the political base has also been taking place, as political power is gradually shifting away from the dominance of male ranchers who have been in the area for a long time, to include both newcomers and females in elected positions.

Oil shale projects in Piceance Basin had little social impact on Rangely because there was no good road connecting Rangely to C-a Tract. A similar situation limits the number of Deseret Power Plant workers who might otherwise live there instead of in Jensen or Vernal, Utah.

Rangely has shared with Meeker the establishment of the countywide Advisory Group and the Human Resources Council. Some services formerly based in the county seat of Meeker now have branches in Rangely (for instance, the Mental Health Clinic). The two communities also share law enforcement.

The slump affecting Meeker and Rifle has not occurred in Rangely because it had fewer workers in oil shale, and also because of the influx of workers for construction of various portions of the Moon Lake Power Project.

No up-to-date attitude studies are available for Rangely, but there now apparently exists some concern about too rapid growth, a shift from the highly positive orientations and preparations which prevailed until very recently. Some tensions between temporary workers and the permanent local citizenry have resulted from a tendency to ignore the needs of the temporary workers.

Rifle

Rifle was at the center of an "oil shale boom" at least twice before the present -- in 1913 and again in the late 1940's -- though in each instance the boom was more in expectations than in reality. The skepticism growing from those times made the community doubtful that oil shale would "go" in the 1970's and 1980's. Only recently did skepticism give way to belief -- just in time to be shattered by the slow-down of oil shale development in the region.

Rifle has prepared for growth by various funding methods. Boom conditions have existed since the late seventies as population increases began producing shortages and congestion as well as some better shopping facilities, and expansion and improvement of social services delivery systems such as mental health. A newcomer integration project, a branch of Colorado Mountain College and programs for the elderly are well under way. A $100 million Human Services building plan is going forward, in which space will be free to services providers.

Other responses to structural pressures have also occurred. Efforts to control downtown congestion on Railroad Avenue (Hwy. 13 north-south) caused some citizen/local government conflicts because of disagreements regarding a by-pass route. This by-pass, now completed, is just west of town. In the most recent local election (late 1981), three of five new council members were new residents, evidence that the political base is diversifying in Rifle. Rifle has more than tripled its population since 1972.

According to a recent BLM study (1981) based on a random sample of 109 persons, the people of Rifle favor energy development by a two-thirds majority, but not at the expense of a deteriorating environment. Longtime residents felt the stresses of seeing their community become more congested and less psychologically comfortable, but in general they also saw some advantages such as better employment opportunities for the younger population. They were glad for better shopping facilities, and they believed the country needs the oil. Respondents in this study saw the biggest problems as rise in living costs, traffic congestion, higher crime rates, and housing shortages. Fifteen percent mentioned concern about the natural environment.

In-depth interviewees ranked wildlife as of highest priority among BLM responsibilities, with watershed second. The other four choices (range, timber, recreation, and energy and minerals) ranked about equally. Further details from this attitudinal study of Rifle are given in Appendix A.

BLM decisions and actions in this planning area, except for those associated with oil shale or other minerals, should have little measurable social impacts on other communities. If sizeable energy or minerals mining should occur, however, small communities near Rifle (Silt, New Castle, Parachute) would probably be affected to some minor degree. These, like Rifle, grew due to oil shale work on the Roan Plateau, and have shared in the general turmoil accompanying the Colony slowdown. They are, in general, prepared for further growth.

Sizeable oil shale or minerals development in this planning area would also bring at least some company white collar personnel and secondary workers to Grand Junction, which is, likewise, able to absorb more population.

ECONOMICS

Impacted Area

Economic data is available only by county. Therefore, an impacted area for economic analysis has to be defined in terms of whole counties. The impacted area for this analysis consists of Garfield, Mesa and Rio Blanco Counties.

Employment and Income

Employment and income figures are shown in Table II-21. The figures are by place of residence. For this reason they will differ from most other employment and income figures, which are by place of work and do not take commuting into account.

Both Garfield and Mesa Counties have diversified economies. Garfield County has an important tourist trade. Mesa County is a business and manufacturing center and has a large agricultural sector. Rio Blanco County, in contrast, has a major part of its present economy based on mineral development. Livestock production remains an important factor in all three counties, but has become small numerically compared to the other developments. Rio Blanco County also has a tourist trade, dominated by fall hunting and summer mountain recreation.

Figures for 1982 reflect the oil shale projects prior to their suspension. Present employment levels are lower, as is indicated by the sharply higher unemployment ratio in latter 1982.

TABLE II-21

CURRENT EMPLOYMENT

	Employment			Percent of Total		
	1980	1981	1982	1980	1981	1982
Garfield County						
Agriculture	596	584	572	5.3	4.4	4.2
Mining	608	845	817	5.4	6.4	6.0
Construction	1,241	1,918	2,087	11.0	14.5	15.4
Manufacturing	213	280	291	1.9	2.1	2.2
Trans., Comm., Utilities	773	851	862	6.9	6.4	6.4
Trade	2,256	2,556	2,604	20.0	19.3	19.2
Finance, Insurance, real estate	358	400	403	3.2	3.0	3.0
Services	1,780	1,977	2,006	15.8	14.9	14.8
Government	1,977	2,326	2,372	17.6	17.5	17.5
Unclassified	1,450	1,519	1,528	12.9	11.5	11.3
Total	11,253	13,260	13,547	100.0	100.0	100.0
Total labor income (000)	$146,847	$198,447	$200,570			
Percent unemployment	4.1	4.3	8.2*			
Mesa County						
Agriculture	1,896	1,858	1,821	5.2	4.9	4.7
Mining	2,044	2,010	1,926	5.6	5.3	5.0
Construction	2,733	3,152	3,207	7.5	8.2	8.3
Manufacturing	2,664	2,844	2,943	7.3	7.4	7.6
Trans., Comm., Utilities	2,421	2,497	2,520	6.6	6.5	6.5
Trade	8,269	8,728	8,849	22.6	22.8	23.0
Finance, Insurance, real estate	1,325	1,379	1,390	3.6	3.6	3.6
Services	6,420	6,686	6,771	17.6	17.5	17.6
Government	5,076	5,431	5,469	13.9	14.2	14.2
Unclassified	3,676	3,678	3,638	10.1	9.6	9.5
Total	36,525	38,268	38,538	100.0	100.0	100.0
Total labor income (000)	$496,207	$534,211	$536,514			
Percent unemployment	3.5	3.6	6.6*			
Rio Blanco County						
Agriculture	290	283	277	6.1	5.4	5.0
Mining	1,563	1,726	1,624	32.7	32.8	29.2
Construction	1,097	1,211	1,445	22.9	23.0	26.0
Manufacturing	30	42	60	.6	.8	1.1
Trans., Comm., Utilities	180	194	203	3.8	3.8	3.6
Trade	375	424	475	7.8	8.1	8.6
Finance, Insurance, real estate	24	32	39	.5	.6	.7
Services	160	197	237	3.3	3.8	4.3
Government	724	784	828	15.1	14.9	14.9
Unclassified	345	357	367	7.2	6.8	6.6
Total	4,788	5,255	5,558	100.0	100.0	100.0
Total labor income (000)	$92,557	$102,520	$109,119			
Percent unemployment	1.9	2.3	5.1*			

* September 1982

Population

Table II-22 shows 1980 populations.

Mention needs to be made of Census county divisions. In cooperation with local officials, the Census Bureau divides most counties into two or more parts. Maps of the county divisions can be found in Population Census reports. In the impacted area, most of which is sparsely populated, the great majority of a county division's population is located in or adjacent to its communities. For this reason, and because city boundaries can readily be changed, it is believed that county divisions make a better base for projections than present city limits. Therefore, all projections will be for county divisions and should be compared to the 1980 division populations.

Because Grand Junction has a metropolitan-type development, the Clifton and Grand Junction Divisions are used to represent that area.

Uneven population distribution characterizes the impacted area. The majority is located in the Grand Junction area of Mesa County. Garfield County's population is heavily concentrated in the central and eastern parts of the county. Settlement in Rio Blanco County is clustered around its two communities: Meeker and Rangely. Areas between these population nodes consist of sparsely settled ranching country and unpopulated national forest.

TABLE II-22

1980 POPULATION

	County	County Division	Community
Garfield County	22,514		
Glenwood Springs Division		12,394	
Carbondale			2,084
Glenwood Springs			4,637
Grand Valley Division		956	
Parachute			338
Battlement Mesa			0
New Castle Division		3,943	
New Castle			563
Silt			923
Rifle Division		5,221	
Rifle			3,215
Mesa County	81,530		
Collbran Division		1,862	
Collbran			344
DeBeque Division		449	
DeBeque			279
Fruita Division		8,892	
Fruita			2,810
Grand Junction Area*		67,894	
Grand Junction			28,144
Palisade			1,551
Other Divisions		2,433	
Rio Blanco County	6,255		

TABLE II-22—Continued

1980 POPULATION

	County	County Division	Community
Meeker Division		3,642	
Meeker			2,356
Rangely Division		2,613	
Rangely			2,113

* Grand Junction and Clifton Divisions

Housing

Vacancy rates were less than 10 percent in 1980 (indicative of a housing shortage) in five of the communities: New Castle, Silt, Fruita, Grand Junction and Rangely. Housing remains scarce and expensive in Rangely and Dinosaur because they are currently impacted by development associated with the Moon Lake Power Project. Conditions have become less stringent since 1980 in New Castle, Silt, Fruita and Grand Junction as reduced population growth has allowed construction to catch up with (and in some cases exceed) demand. Vacancy levels in Table II-23 should be treated with caution because the housing situation in many communities has changed in the ensuing three years and because they do not indicate either physical condition or whether they are year-round or seasonal units.

TABLE II-23

1980 HOUSING UNITS

	Occupied	Vacant
Garfield County		
Carbondale	724	106
Glenwood Springs	1,930	230
New Castle	233	22
Parachute	129	15
Rifle	1,170	200
Silt	331	26
Mesa County		
Collbran	135	24
DeBeque	107	29
Fruita	947	78
Grand Junction	11,766	940
Palisade	585	72
Rio Blanco County		
Meeker	846	135
Rangely	684	59

CHAPTER II

Industries that may be Directly Impacted

Livestock Grazing

Livestock production is the principal agricultural activity in the Piceance Basin Planning Area. Crop production is dominated by hay for livestock use. Estimated 1980 earnings from livestock and products in Rio Blanco County are $7,778,000, while crop production earnings total $914,000 (U.S. Dept. of Commerce 1982).

Irrigation is important to agriculture in the region's dry climate. Slightly over one-half of Rio Blanco County's harvested acreage in 1980 was irrigated, mostly hay. Some pasture is also irrigated, but the amount is not recorded (Colorado Department of Agriculture 1981).

Mining

Mining is the most important industry in Rio Blanco County, providing 29 percent of 1982 total employment and 87 percent of 1979 basic industry sales (estimated from McKean and Weber 1978). Oil and gas are the dominant products, accounting for 98 percent of the $420 million value of mineral production in 1980. Coal and oil shale provided most of the remainder (Colorado Department of Natural Resources, Colorado Division of Mines 1981). Oil shale production from pilot projects was included in the county's mining figures.

Recreation

Hunting is the most significant recreation activity in the Piceance Basin Planning Area. In 1981, an estimated total of 87,000 days were spent by non-resident hunters in Rio Blanco County. At an average of $6.62 per day in 1980 dollars (derived from McKean and Weber 1978), for non-resident hunters the economic value to the county was about $570,000. An estimated 16,000 non-resident hunter days, 18 percent of the county total, were spent in the Piceance Basin area. Hunting of deer and elk, the two most important game animals in the Piceance Basin, contributed some $100,000 or 18 percent, of the total value. No figure for economic value of resident hunters (3,500) was determined. Note: Hunting levels fluctuate greatly depending upon game populations. For instance, in 1979, hunting levels were some 73 percent higher.

Local Government Finances

Area communities obtain most of their revenues locally. As shown in Table II-24, local sources account for 67 to 95 percent of total community revenues. This large dependence on local sources means that the communities can be highly impacted by developments that affect their tax base. Area school districts are less dependent on locally-generated revenues because of the state equalization formula (Table II-25). The only districts which obtain more than 70 percent of their funds locally, are two that have high per capita assessed valuations from mineral development.

Rough measures of local funding sources are provided by per capita figures on assessed valuation and retail sales. They show that, in general, the larger communities have more substantial property tax bases, but that school district property tax bases and community sales tax bases vary according to individual circumstances. The sales tax aspect is important because those revenues account for up to 31 percent of total community revenues, with a median figure of 22 percent. Those communities having strong retail sales bases, generally because they are either business or tourist centers, will be in a better position to handle financial impacts.

At present, the communities' ability to increase these revenue sources is restricted. State law imposes a seven percent limit on annual increases in property tax revenues, and a four percent ceiling on combined municipal and county sales tax rates. Since only Rio Blanco County presently has a sizable sales tax, most of the communities have some leeway to raise revenues by that means. School district property tax revenues are controlled by the state equalization formula.

Figures on remaining bonding capacity in Tables II-24 and II-25 indicate two things: (1) how much major capital improvement could be funded from local resources and (2) the size of the existing debt burden. State law imposes the ceilings shown in the footnotes. All but three of the communities and all of the school districts have more than half of their bonding capacity still available for use. However, the amounts would still be insufficient to meet the needs of major growth. Conversely, since only one community (and no school districts) has a general obligation indebtedness exceeding $300 per capita, existing debt burdens should not become a problem.

TABLE II-24

COMMUNITY FINANCIAL DATA

	Carbondale	Glenwood Springs	New Castle	Parachute	Rifle	Silt	Collbran	DeBeque	Fruita	Grand Junction	Palisade	Meeker	Rangely
Source of revenue (1980 %) [1]													
Local	92	95	93	87	94	75	91	87	90	93	95	67	73
State	5	3	6	11	3	20	6	9	5	4	3	30	23
Federal	3	2	1	2	3	5	3	4	5	3	2	3	4
Assessed valuation (1/1/82)													
Total (000)	$6,995	$23,895	$1,005	$685	$12,233	$1,514	$693	$588	$7,911	$128,649	$3,937	$7,008	$8,405
Estimated per capita	2,200	3,140	1,250	730	2,570	1,170	1,960	1,100	2,720	2,600	2,160	2,690	3,280
Mill levy (1/1/82)	7.80	8.00	11.105	14.306	10.49	20.015	22.29	18.99	15.00	12.00	24.35	8.83	18.94
Retail sales (FY 1981)													
Total (000)	$16,955	$164,718	$2,052	$2,237	$55,155	$2,300	$1,959	$671	$17,596	$750,291	$6,700	$19,398	$47,421
Estimated per capita	5,870	22,780	3,060	3,700	12,960	2,150	5,650	1,740	6,160	15,740	4,000	7,730	21,530
Sales tax rate (7/1/81 %)	3.0	2.0	2.0	2.0	2.0	3.0	2.0	2.0	3.0	2.0	1.0	[3]	[3]
Bonded debt (12/31/80)													
General obligation (000)	$81	$2,070	$180	$0	$441	$71	$0	$0	$505	$5,800	$685	$0	$221
Revenue (000)	1,397	415	0	0	374	0	0	95	51	8,655	320	1,347	666
Remaining bonding capacity (000) [2]	619	[4]	0	68	[4]	80	69	59	286	[4]	0	701	619

[1] Figures include enterprise funds (water and sewer service, etc.) but exclude large one-time federal and state grants.
[2] Three percent of actual valuation less general obligation bonded debt.
[3] Receives county sales tax (2.0 percent) revenue collected within city limits.
[4] Home rule cities are exempt from bonding limit.
Source: Colorado Division of Local Government 1980 Local Government Financial Compendium, and files. Colorado Division of Property Taxation, Eleventh Annual Report 1981. Colorado Department of Revenue, Annual Report 1981.

TABLE II-25

SCHOOL DISTRICT FINANCIAL DATA

Roaring Fork School District	Rifle School District	Grand Valley School District	DeBeque School District	Plateau Valley School District	Mesa Valley School District	Meeker School District	Rangely School District
Source of revenue (1980 %)							
Local	61	41	59	72	46	49	68	95
State	37	57	37	28	51	48	28	4
Federal	2	2	4	0	3	3	4	1
Assessed valuation (1/1/82)								
Total (000)	$60,557	$33,342	$5,928	$18,116	$10,499	$328,272	$34,006	$300,786
Estimated per capita	4,450	3,010	2,830	23,060	5,520	3,960	9,000	93,940
Mill levy (1/1/82)	47.12	45.71	53.87	25.94	41.47	47.44	51.08	9.19
Bonded debt (12/31/80) (000)	$3,470	$1,840	$46	$17	$0	$0	$830	$0
Remaining bonding capacity (000) [1]	8,641	4,828	1,140	3,606	2,100	65,654	5,971	60,157

[1] Twenty percent of assessed valuation less bonded debt.

Source: Colorado State Auditor, files. Colorado Division of Property Taxation, Eleventh Annual Report 1981. Briscoe, Maphis, Murray and Lamont, Chevron Shale Oil Company Clear Creek Project, Draft Socioeconomic Assessment, Existing Conditions Vol. 2.

NOISE

Existing noise levels in the Piceance Basin vary between 35 and 45 decibels (dB). Noise sources are primarily natural, such as wind, but additional noise comes from aircraft (50 dB) and traffic on nearby roads. The equivalent continuous noise level for Colorado Highway 64 is 66 dB, and for Colorado Highway 13 is 67 dB. Noise levels along Piceance Creek Road would be similar. Noise levels at specific sites involving construction or operation of machinery can reach 65 dB to 75 dB. A level of 55 dB is considered by the Environmental Protection Agency to be the level above which annoyance occurs in a residential neighborhood. A similar threshold has not been established for rural areas.

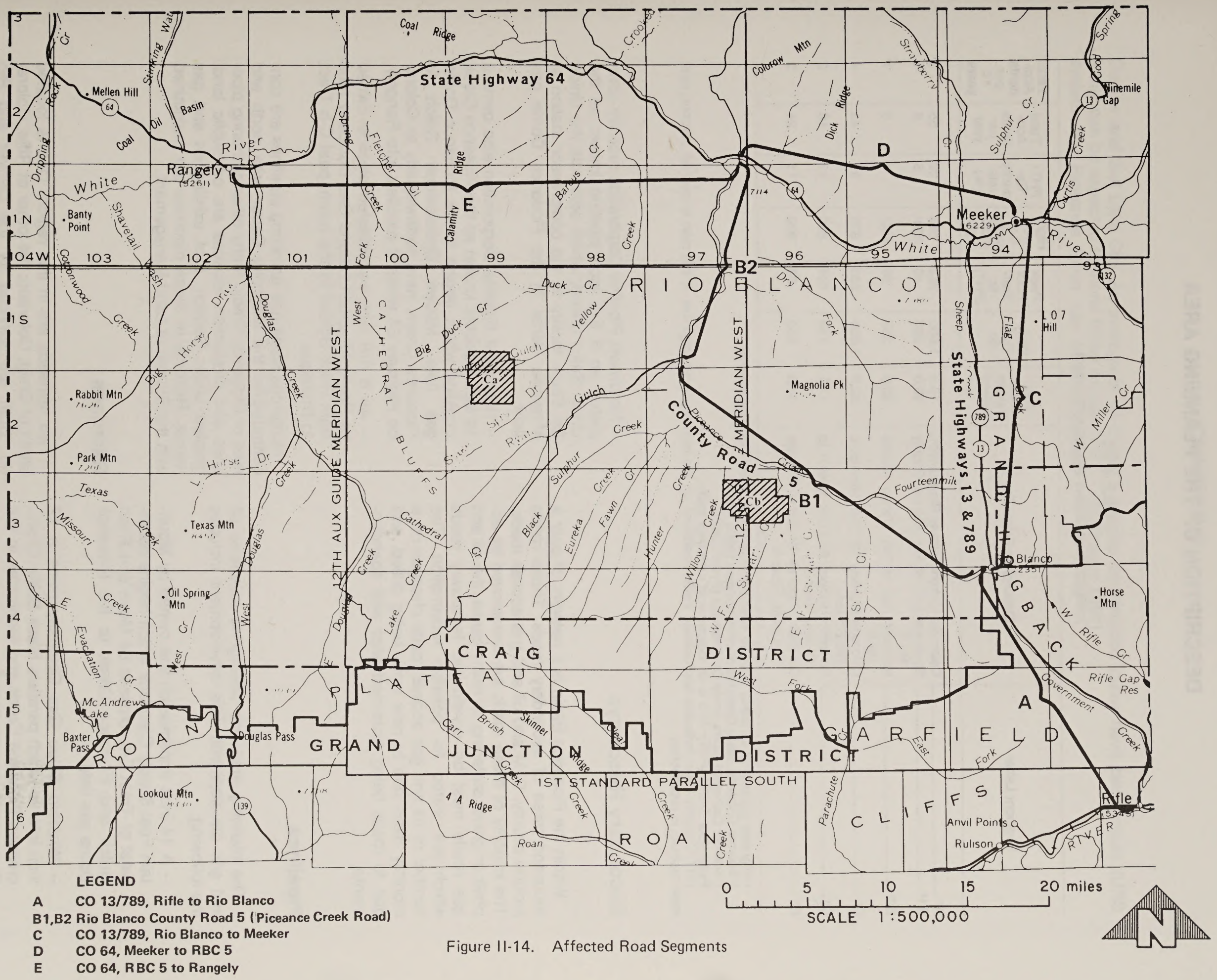
TRANSPORTATION

Primary Roadways

Major highways and county roads which service the Piceance Basin are Colorado State Highway 13/789 which runs from Rifle to Meeker, Colorado State Highway 64 which runs from Rangely to Meeker, and Rio Blanco County Road 5 (also known as Piceance Creek Road) which forms a loop between Colorado 13 and Colorado 64. Figure II-14 shows the location of these roads. A 23.5 mile gravel surfaced county road is currently under construction between C-a Tract and Rangely.

Current highway use for the segments studied is well under capacity. Capacities for state highways are figured with an average travel speed of 50 miles per hour, and 40 miles per hour for county roads. Colorado 13/789 receives the most use, and also has the largest number of accidents. Table II-26 illustrates highway use, capacity and accident statistics.

An undetermined amount of pavement damage occurs on these road segments from current use. Presently, there is no large scale trucking of minerals to a point of destination. Most heavy truck traffic occurs from oil and gas, and construction activities.



LEGEND

- **A** CO 13/789, Rifle to Rio Blanco
- **B1,B2** Rio Blanco County Road 5 (Piceance Creek Road)
- **C** CO 13/789, Rio Blanco to Meeker
- **D** CO 64, Meeker to RBC 5
- **E** CO 64, RBC 5 to Rangely

Figure II-14. Affected Road Segments

TABLE II-26

AFFECTED HIGHWAY SEGMENTS (1980)

Segment Letter	Description From/To	Segment Length (miles)	Daily Traffic	Peak Hour Traffic (PHT)	Highway Capacity at 50 mph	PHT/ Capacity rate (%)	Total Accidents per year	Fatal Accidents per 10 years
A[2]	Colorado 13 from Rifle to Rio Blanco....	19.3	1,800	252	865	29	55	3
B1[3]	Southern half of Rio Blanco County Rd 5.	19.0	300	40	850[1]	5	8	1
B2[3]	Northern half of Rio Blanco County Rd 5.	20.0	200	30	850[1]	4	6	1
C[2]	Colorado Highway 13 From Meeker to Rio Blanco.	22.3	1,680	235	875	27	44	4
D[2]	Colorado Highway 64 From Meeker to County Road 5.	17.1	740	104	820	13	18	2
E[2]	Colorado Highway 64 From Rangely To County Road 5.	36.5	630	88	820	11	24	3

[1] Highway capacity at 40 rather than 50 miles per hour due to lower design standards.
[2] Source: Colorado State Department of Highways (1980a and b).
[3] Source: Cathedral Bluffs Shale Oil Company (Pysto 1982).
Peak Hour Traffic (PHT): This is an indication of rush hour traffic.
PHT/Capacity Rate: Indicates approximate traffic conditions on the highway during high use. If this ratio is near 85 percent, rural road capacity is approached.

Secondary Roadways

Within the Piceance Basin is a network of over a thousand miles of secondary roads. These roads include county, BLM and oil and gas access roads. The majority of these roads are unimproved by asphalt or gravel surfacing. In many cases, the oil and gas roads must be considered temporary roads which are slated for possible reclamation. The number of oil and gas access roads changes on a monthly basis due to new wells being drilled, and due to roads being reclaimed after well abandonments.

Pipelines

The planning area has undergone extensive oil and gas development. This development includes the following:

-- A 14 inch transmission line owned by Mountain Fuel Supply Company which begins southwest of Tract C-a, crosses 84 Mesa and Ryan Gulch and Piceance Creek to the Piceance Dome gas field.

-- Western Slope Gas Company owns a 12 inch intertie which parallels Black Sulfur Creek, crosses Piceance Creek and terminates in the Piceance Dome gas field.

-- Northwest Pipeline Corporation recently completed an 8 5/8 inch pipeline known as the Union Sales lateral, which connects the Union Oil Shale facility to the compressor station at Magnolia Camp in the Piceance Dome gas field.

-- Northwest Pipeline Corporation also owns a 10 inch trunkline known as the Piceance Creek trunkline which begins in the Piceance Dome gas field, follows Greasewood Gulch to Piceance Creek, runs northwesterly to Colorado Highway 64 which it parallels into Rangely.

-- An 8 5/8 inch transmission pipeline owned by Rocky Mountain Natural Gas Company runs from Rock School to the south, past C-b Tract to DeBeque.

Numerous small gas gathering pipelines are concentrated in the Magnolia Camp area north and east of Piceance Creek. Many other gathering pipelines and production facilities are on public land, granted under Section 1 of existing oil and gas leases. Records of these pipelines are maintained with the Bureau of Land Management.

Railroads

Two railheads are in this region. One is located south of Craig, Colorado; the other at Rifle, Colorado. Both are serviced by the Denver and Rio Grande Western Railroad, which runs between

Denver and Salt Lake City. An average of 14 trains a day can be expected to travel these routes. A rail system into Piceance Basin has been proposed, but no construction plans have been made (URS Engineers 1981).

Chapter III
Resource Management Alternatives

CHAPTER III
RESOURCE MANAGEMENT ALTERNATIVES

This chapter describes five potential alternatives to multiple-use land management in the Piceance Basin Planning Area. There is also a brief discussion of those alternatives that were considered but eliminated from detailed analysis. These alternatives respond to the issues raised by the public and discussed in Chapter I. Each alternative narrative is discussed by resource, and is summarized in Table III-1. Each alternative is a complete, reasonable, implementable, resource management plan for the planning area, describing the management practices to be employed, where the emphasis on a particular resource value would be placed, and different means of achieving balanced resource management with differing management priorities.

The alternative maps included in Volume 2 of this document attempt to visually summarize the decisions made. They should be used in conjunction with the alternative narratives described below, not independently. The management priority areas are defined in the Map Addendum, Volume 2 and the compatibility of different resource management practices for each priority area is described. It should be noted that assigning management priority areas for particular resources does not necessarily exclude other resources. The compatibility of managing more than one resource in each priority area is the essence of multiple-use management. It is critical to understand the priority areas assigned to each resource and the compatibility of other resource values within those priority areas.

The five alternatives discussed in this chapter cover a broad range of resource management options. They are: **Current Management Alternative**or "No Action" which describes the management of the planning area as it exists today and how it would be anticipated to continue if this alternative were selected. The **Wildlife Alternative, Oil and Gas Alternative,** and **Oil Shale Alternative** describe different management options that alter priorities to accomplish different management policies. The **Preferred Alternative** is the optimum combination of management options that is the most acceptable resolution of the planning issues identified at the outset of the planning process. It was identified after considering the environmental consequences of the other four alternatives, balancing the land uses and resource values of the planning area, and considering the long-term public interest and benefits of implementing the alternative. The alternative names attempt to describe the emphasis of each alternative but are not fully descriptive. The reader is encouraged to read the alternative summary (Table III-1) to get a better understanding of the objectives of each alternative. The names are intended to assist the reader in associating the alternatives with the specific management policies contained in those alternatives for ease of comprehension while reading the rest of the document.

Figure III-1 shows the oil shale mining claims made prior to the Mineral Lands Leasing Act of 1920 in the planning area. The validity of these claims is uncertain. Some claimants have applied for patent and the claims are being contested before an Administrative Law Judge, the Interior Board of Land Appeals or in Federal District Court, depending upon how far they have been appealed. Others have applied for patent and are being examined by BLM to determine whether the claim should be contested. The remaining claimants have not applied for patent. As long as the validity of these claims is undetermined, implementation of the decisions in all of the alternatives that would affect the mineral resource values of these claims, or the mineability of the oil shale resource, will be deferred. On these mining claims, therefore, such decisions are all considered to be interim management decisions and would not be implemented unless, and until, the validity of the claims is determined.

It should also be noted that all of the alternatives recognize the existence of valid and existing rights. Nothing in the management options identified should be interpreted as challenging those rights.

TABLE III-1

PICEANCE BASIN RESOURCE MANAGEMENT PLAN - ALTERNATIVE SUMMARY

Resource Element	Alternatives				
	Current Management	Wildlife	Oil and Gas	Oil Shale	Preferred
Objectives	Continue with existing management. Serves as "No Action" alternative. Existing decisions carried forward include White River Management Framework Plan (1981), Rangeland Management Program (1980), Coal Amendment to MFP (1981), Oil and Gas Management Program (1981) and other resource activity plans.	Emphasize management and use of public lands for benefit of wildlife and related values. Discourage surface-disturbing activities and other actions that would adversely impact wildlife.	Emphasize management of lands to plan for and provide for oil and gas development and transportation, and access to public lands for other resource values.	Emphasize management of lands for oil shale development, production and transportation.	To achieve the combination of management options that is the most acceptable resolution of the planning issues after considering the potential impacts of all alternatives.
Air Resources	Minimize air quality degradation through legal compliance, monitoring, analysis and impact mitigation. Project specific evaluations on a case-by-case basis.	Same as Current Management Alternative.	Same as Current Management Alternative.	Maximum air quality degradation with applicable laws, regulations and implementation plans. Intensive management of the air resource through monitoring, analysis, permit compliance and impact mitigation. Project specific evaluations on a case-by-case basis.	Minimize air quality degradation through legal compliance, monitoring, analysis and impact mitigation. Increased air resource "budgeting" to ensure balanced multiple resource utilization. Project specific evaluations on a case-by-case basis.
Oil Shale	Encourage multimineral development; provide for open pit, in-situ or other underground development.	Limit leasing to methods with least disturbance. No new open pit (except C-a and extension). Encourage multimineral.	Stipulations placed on oil shale to permit oil and gas development. No oil shale leasing in multimineral area (depocenter). Additional open pit mines accommodated, and underground mines outside multimineral zone.	Oil shale leasing would have highest priority. Leasing would make available lands for different kinds of oil shale development. Multimineral development required in multimineral zones.	Allow for additional open pit leasing (in addition to C-a and extension) within open pit zone located so as not to interfere with potential C-a migrating pit, and when assured that offsite disposal needs can legally be met. Postpone oil shale leasing in multimineral area (depocenter) until improved recovery rates are proven. In KGS, oil and gas have priority, otherwise oil shale does. Underground mining outside multimineral zone accommodated.
	Eight tracts identified and ranked in priority order for leasing.	No tracts identified. Priority area for oil shale does not allow for new open pit.	No tracts identified. Depocenter reserved; Piceance dome area excluded.	No tracts identified. Most of oil shale resource area available.	No tracts identified. Priority area for oil shale stretching from northwest of C-a to south and east, staying to south of Piceance Creek.
	Consider new oil shale leasing once prototype tracts are developed, or to develop new mining technology. New leases should be grouped or adjacent to existing leases.	Consider new leasing when prototype tracts are developed and operating commercially. No more than one tract leased every five years.	Future lease offerings based on demand, and progress and success of existing leases. No more than two leases every five years.	Lease offerings to begin by 1986 and considered at least every five years. Number and timing of leases not to exceed carrying capacity. Encourage dispersed development.	Future lease offerings based on demand, and progress and success of existing oil shale projects. Sequential lease offering process would be followed whereby critical carrying capacities are not exceeded. Monitor impacts as development occurs so as not to allow additional leasing if carrying capacities may be exceeded.

	No decisions on off-tract disposal.	No new off-tract disposal (except for C-a).	Off-tract disposal considered within legal constraints if oil and gas recovery not affected.	Off-tract disposal considered as proposed within legal constraints.	Off-tract disposal considered within legal constraints. If legislatively authorized, future off-tract leases that are proven necessary would be considered to accommodate private or Federal development, provided other critical resource values are not significantly impacted.
	Exchanges treated on case-by-case basis.	Exchanges included in lease limits.	Exchanges included in lease limits. Same location constraints as leasing.	Exchanges considered as proposed, but still counted in carrying capacity.	Exchanges subject to contraints of carrying capacity. Same location contraints as leasing i.e., reserve depocenter, exclude Piceance Dome area. Priority given to small areas that facilitate private development. Exchanges of large blocked up Federal lands discouraged.
	Consider research tracts on case-by-case basis.	Evaluate small research tracts on merits of technology and availability of alternate private lands. No commercial.	Evaluate research tracts on merits of technology.	Research tracts considered as proposed.	Evaluate small research tracts on merits of technology and availability of alternate private lands. No commercial.
Sodium	No additional sodium leases until existing leases and PRLAs developed. Encourage future leasing concurrently with oil shale. Discourage sodium-only leasing.	No sodium-only leasing, only concurrent with oil shale.	Sodium-only leases allowed once existing leases and PRLAs are developed.	No sodium-only leasing, only concurrent with oil shale.	Sodium-only leases allowed once existing leases and any approved PRLAs are developed.
Coal	Total of 29,610 acres determined acceptable for future underground coal leasing. Of this acreage, 24,635 acres are also acceptable for surface mining.	Future coal leasing consideration would only be for underground methods on a total of 29,610 acres.	Future coal leasing would favor 29,610 acres identified as acceptable for underground methods. Lease stipulations would provide for future extraction of oil and gas.	All coal lands determined to be acceptable for coal development would be open for future leasing. A total of 29,610 acres determined acceptable for underground coal leasing. Of this acreage 24,635 acres are acceptable for surface mining.	Total of 29,610 acres determined suitable for future underground coal leasing, 24,635 acres suitable for surface mining.
Oil and Gas	Subject to stipulations in Oil and Gas Umbrella EA. Priority within KGSs. All oil and gas lands open. Leases issued on case-by-case basis.	KGSs would have priority, all oil and gas lands open subject to stipulations in Oil and Gas Umbrella EA. New or reissued leases may be subject to additional stipulations for other resource values.	KGSs and tight gas formations and 2 mile buffer around them would have priority for oil and gas. Stipulations placed on oil shale to permit oil and gas development.	KGSs and tight gas formations of higher priority would be committed to oil and gas development. Stipulations applied to oil and gas leases to permit oil shale development.	Subject to stipulations in Oil and Gas Umbrella EA. Priority within KGSs. All oil and gas lands open. Stipulations placed on oil shale in KGSs to permit oil and gas development. New or reissued leases may be subject to additional stipulations for other resource values.
Locatable Minerals	None currently being developed, most of planning area clsed to mineral entry due to oil shale withdrawal.	(Same as for Current Management Alternative.)	(Same as for Current Management Alternative.)	(Same as for Current Management Alternative.)	None currently being developed, most of planning area closed to mineral entry due to oil shale withdrawal.
Saleable Minerals	Sand and gravel development occurs as requested to fill needs. Site-specific restrictions applied on case-by-case basis.	Existing or previously used sand and gravel sites would be favored. Development excluded from areas of sensitive environmental values.	Mineral materials inventory would be conducted to identify best sand and gravel areas. Development would occur as demand required. Development excluded from mandatory protection areas.	(Same as for Oil and Gas Alternative.)	Mineral materials inventory would be conducted to identify best sand and gravel areas. Development would occur as demand required. Development excluded from mandatory protection areas. Existing and previously used sites would be favored. Site-specific restrictions would be applied on case-by-case basis.

TABLE III-1—Continued

PICEANCE BASIN RESOURCE MANAGEMENT PLAN - ALTERNATIVE SUMMARY

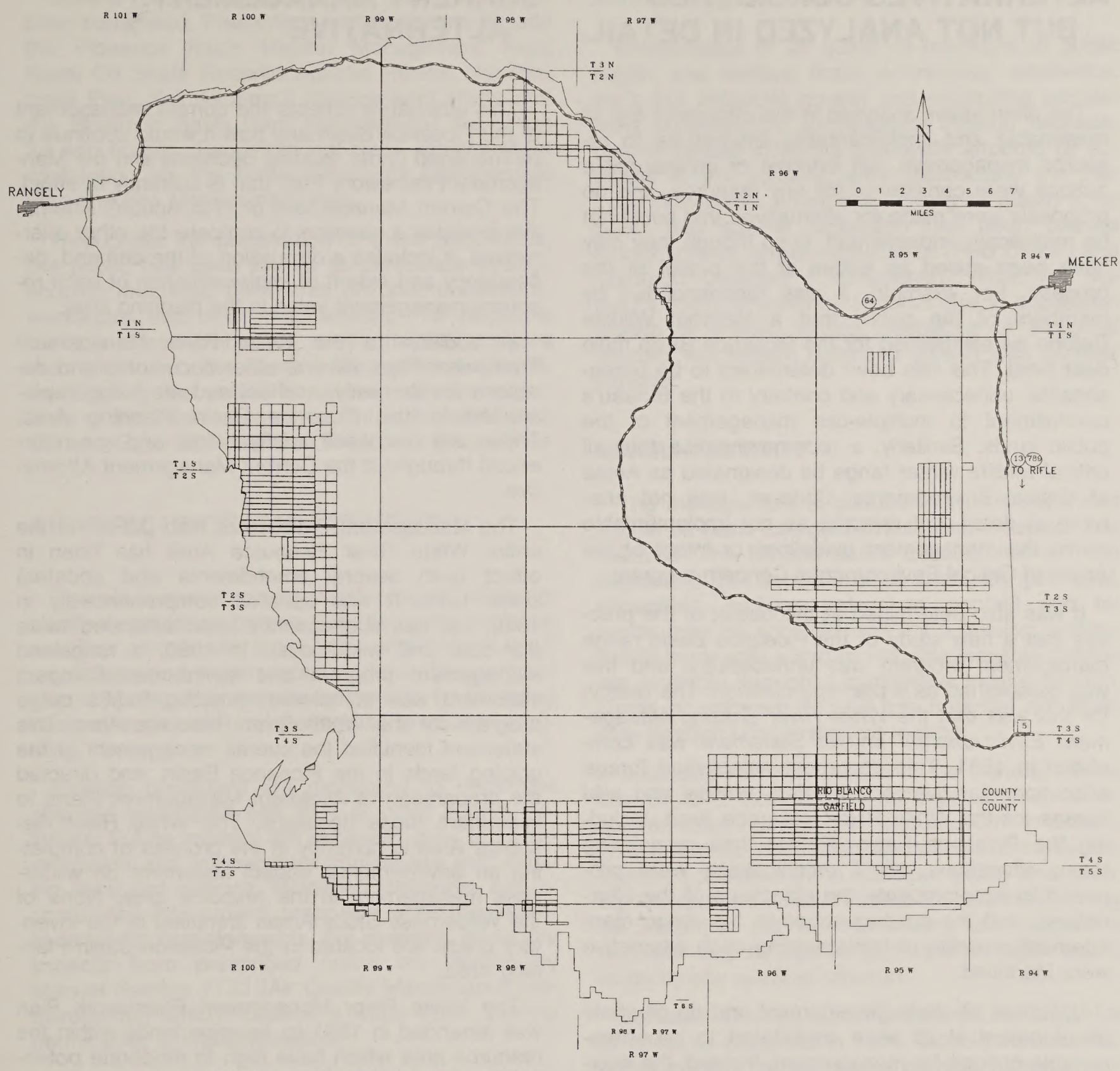
Resource Element	Alternatives				
	Current Management	Wildlife	Oil and Gas	Oil Shale	Preferred
Water Resources	Maintain water quality at existing levels. Proceed with currently scheduled spring source and stream channel stability studies.	Complete inventories. Maintain streams that meet state standards through management practices, improve where practical those that don't meet standards. Identify sensitive watersheds though watershed management plans. Improve sensitive watersheds with intensive management practices. Restrict use of public lands to protect sensitive watersheds and streams not meeting minimum standards. Limit ORV use in sensitive watersheds.	Complete inventories. Maintain streams that meet state standards through limited management practices, improve those that don't meet standards. Identify sensitive watersheds through watershed management plans. Improve sensitive watersheds with intensive management practices implemented by other resource programs.	(Same as Oil and Gas Alternative.)	Complete spring and stream channel inventories. Establish baseline conditions based on results of inventory. Develop watershed management plans to meet state water quality standards and improve and/or protect from further degradation those streams that do not meet state standards. To the extent possible, do not allow degradation of groundwater quality or quantity. Spring reliant uses supplied by groundwater must be mitigated. Monitoring and mitigation stipulated on mining activities by lessee or through industrial association. Limit ORV use in sensitive watersheds.
Soils	Protect, maintain or improve the quality of the soil resource. Recommendations on project restrictions to protect soils are made on a case-by-case basis.	Maximize productivity of the soil resource. Minimize disturbances on productive or fragile soils. Other restrictions would be applied to surface disturbing activities, including seasonal ORV closures on all BLM roads and trails when roads saturated to 3 inches.	Impede deterioration of soil conditions. Stabilize and rehabilitate areas of accelerated erosion.	Maintain present soil conditions through standard stipulations.	Protect, maintain or improve the quality of the soil resource. Avoid erosive, saline or steep slopes where possible. Application and enforcement of reclamation measures on surface disturbing projects. Seasonal ORV road closures as in Wildlife Alternative, and improve road maintenance would occur.
Forestry	5-year sale plan in effect. 2,500 cords of pinyon-juniper firewood and 250,000 board feet of Douglas fir sawtimber annually.	(Same as Current Management Alternative.)	Maximize forest product sales to 4,000 cords of firewood and 300,000 board feet of sawtimber annually.	Reduce forest product sales to 1,000 cords of firewood and 100,000 board feet of sawtimber annually.	5-year sale plan in effect. 2,500 cords of pinyon-juniper firewood and 250,000 board feet of Douglas fir sawtimber annually. Prepare Forest Management Plan.
Livestock Grazing	Implement grazing management plan. Maximum authorized use is 57,016 AUMs. Present average is 55,334 AUMs. Long-term (20 years) allocation is 64,011 AUMs.	Long-term forage allocation to livestock of 64,011 AUMs.	(Same as Wildlife Alternative.)	Use adjustments may be necessary on allotments when oil shale development occurs.	Implement grazing management plan. Maximum authorized use is 57,016 AUMs. Present average is 55,324 AUMs. Long-term (20 year) allocation is 64,011 AUMs. Use adjustments may be necessary when oil shale development occurs.
Wild Horses	Implement Wild Horse Herd Management Plan. Herd population objective is 100 horses. Current herd is approximately 159 horses.	Reduce herd size to 65-100 horses by 1988 and manage to sustain that herd.	(Same as Wildlife Alternative.)	Reduce herd size to maximum of 65 horses. Use adjustments may be necessary when oil shale development occurs.	Implement Wild Horse Herd Management Plan. Herd population objective is 100 horses. Currently approximately 159 horses. Use adjustments may be necessary when oil shale development occurs.

Wildlife	Implement Piceance Basin Habitat Management Plan to improve habitat conditions of recreational species, raptors and T&E species. Short-term forage allocation to wildlife of 36,160 AUMs, long-term (20 years) allocation of 40,501, to achieve BLM-DOW population objectives.	Wildlife habitat would be intensively managed to optimize wildlife populations. Short-term forage allocation to wildlife of 36,253 AUMs, long-term (20 years) allocation of 48,632 AUMs.	Implement habitat management as funding permits. Short-term forage allocation to wildlife would be 36,253 AUMs, long-term (20 years) allocation would be 40,501.	Habitat management plan would be implemented as amended. Short and long-term forage allocation to wildlife would be 36,253 AUMs. Use adjustments may be necessary when oil shale development occurs.	Implement Piceance Basin Habitat Management Plan to improve habitat conditions of recreational species, raptors and T&E species. Short-term forage allocation to wildlife of 36,160 AUMs, long-term (20 years) allocation of 40,501, to achieve BLM-DOW population objectives. Use adjustments may be necessary when oil shale development occurs.
Rare and Sensitive Plants	Known locations of rare and sensitive plants are avoided where possible. Surveys performed on surface-disturbing projects to avoid such species if necessary.	Protect all known populations of rare and sensitive plants and remnant vegetation associations by excluding surface-disturbing activities.	Protect where possible known populations of rare or sensitive plants from surface-disturbing activities.	Where possible, avoid known locations of rare and sensitive plants and remnant vegetation associations.	Where possible, avoid known locations of rare and sensitive plants. Survey necessary in areas of potential habitat. Fence, monitor and apply no surface occupancy and avoidance stipulations on selected areas as described in Appendix B.
Cultural Resources	Cultural resource inventories and protection are performed in response to individual surface disturbing projects. Standard and special stipulations are applied on a case-by-case basis.	In addition to current management, intensively manage cultural resources to provide for analysis, interpretation and public awareness.	(Same as Current Mangement Alternative.)	(Same as Current Management Alternative.)	Cultural resource inventories and protection are performed in response to individual surface disturbing projects. Standard and special stipulations are applied on a case-by-case basis. Some cultural resources will be intensively managed to provide for analysis, interpretation and public awareness to the extent possible.
Paleontological Resources	Based on a resource potential classification system, paleontological resources are identified and protected on an individual project basis.	(Same as Current Management Alternative.)	(Same as Current Management Alternative.)	(Same as Current Management Alternative.)	Based on a resource potential classification system, paleontological resources are identified and protected on an individual project basis.
Recreation	Manage as extensive recreation management area. Actions taken to provide for hunting and other recreation activities are virtually non-existent due to lack of funding. Entire area open to ORV use.	More intensive management of user areas and services would occur. Upgrade hunter camps, improve access, seasonal visitor services program for hunters established, public access to White River improved. Establish Non-motorized Hunting Area. Hunter concentration areas would be proposed as Special Recreation Management Area (SRMA). Seasonal and permanent ORV closures and restrictions would occur based upon non-motorized hunting, wildlife, soils, watershed and ACEC designations. Recreation Area Management Plan required for SRMAs.	Same as Current Management Alternative except Non-motorized Hunting Area established as a Special Recreation Management Area and ORV closures and restriction occur for non-motorized area, soils and ACECs. Recreation Area Management Plan required for SRMAs.	Intensive management would occur as in Wildlife Alternative plus: establish regional ORV play area and support facilities, develop ORV/hunting map for information.	More intensive management use areas and services would occur. Improve access, seasonal visitor services program for hunters established, public access to White River improved. Establish Non-motorized Hunting Area as a Special Recreation Management Area. Seasonal and permanent ORV closures and restrictions would occur based on non-motorized hunting area, watershed, soils, wildlife and ACEC designations. Recreation Area Management Plan required for SRMAs.
Visual Resources	Visual design would be emphasized to reduce contrast of project.	(Same as Current Mangement Alternative.)	(Same as Current Management Alternative.)	(Same as Current Management Alternative.)	Visual design would be emphasized to reduce contrast of project.
Transportation	Provide access and product transportation as demand occurs. Implement stipulations of Oil and Gas Umbrella EA and request 5 year plan of development be submitted by new lessees to consolidate transportation needs.	Provide for access and require product transportation such as pipelines or railroads to reduce truck transport for major projects. Require 5 year plan of development for new or reissued leases.	(Same as Current Management Alternative.)	(Same as Wildlife Alternative.)	Provide access and product transportation as demand occurs. Implement stipulations of Oil and Gas Umbrella EA and request 5 year plan of development be submitted by new lessees to consolidate transportation needs.

TABLE III-1—Continued

PICEANCE BASIN RESOURCE MANAGEMENT PLAN - ALTERNATIVE SUMMARY

Resource Element	Alternatives				
	Current Management	Wildlife	Oil and Gas	Oil Shale	Preferred
Lands and Realty	Potential utility corridors identified; major linear rights-of-way encouraged to locate in them.	Priority utility corridors designated. Major linear utilities would be encouraged to locate within designated corridors.	Potential utility corridors identified; major linear rights-of-way encouraged to locate in them.	No corridors identified. Criteria established to avoid sensitive resource values.	Priority utility corridors designated. Major linear utilities would be encouraged to locate within designated corridors. Criteria established to avoid sensitive resource values for major linear utilities routing outside of corridors.
	Use authorizations issued on case-by-case basis.	Use authorizations issued on case-by-case basis.	Use authorizations issued on case-by-case basis with priority given to those associated with energy/mineral development.	Use authorizations issued on case-by-case basis with priority given to those associated with energy/mineral development.	Use authorizations issued on case-by-case basis.
	Criteria established for future sale of public lands based on manageability and private needs. 850 acres potentially meet these criteria.	Sales of public lands based on similar criteria as Current Management Alternative. 850 acres potentially meet the criteria. Additional criteria established for future land disposal consideration.	Sales of public lands based on similar criteria as Current Management Alternative. 850 acres potentially meet the criteria however, no acreage limitations placed on sales. Additional criteria established for future land disposal consideration.	Sales of public lands based on similar criteria as Current Management Alternative, but not those that would be key to energy/mineral development or transportation. 850 acres potentially meet the criteria however, no acreage limits placed on sales. Additional criteria established for future land disposal consideration.	Sales of public lands based on similar criteria as Current Management Alternative. 850 acres potentially meet the criteria however, no acreage limitations placed on sales. Additional criteria established for future land disposal consideration.
	Community expansion sales or leases considered as proposed by local communities.	Community expansion sales or leases considered within 3 mile radius of Meeker and Rangely.	Community expansion sales or leases considered within 5 mile radius of Meeker and Rangely.	Community expansion sales or leases considered within 7 mile radius of Meeker and Rangely. New community development considered within 3 mile radius of Rio Blanco and White River City if determined necessary by local officials.	Community expansion sales or leases considered within 5 mile radius of Meeker and Rangely. If growth increases too dramatically for communities to accept and it is determined by local officials that development is required outside existing communities, Rio Blanco and White River City should be considered as logical sites for new community development.
Fire Management	Need for fire management plan identified, but not yet completed. Prescribed burn plan in MFP identifies some 1,000 acres for burning annually.	Prepare and implement a Fire Management Plan. Continue with prescribed burn plan as in MFP.	(Same as Wildlife Alternative.)	(Same as Wildlife Alternative.)	Prepare and implement a Fire Management Plan. Continue with prescribed burn plan as in MFP.
Special Management Areas	No existing RNAs, ONAs or ACECs.	Designate 12 priority RNAs, ONAs, ACECs totaling 23,965 acres.	Designate 3 high priority RNAs, ONAs, ACECs totaling 5,745 acres.	No RNAs, ONAs, ACECs would be designated.	Designate Soldier Creek ACEC with boundary adjustments totaling approximately 160 acres. Management of areas proposed but not designated is described in Appendix B.



Claims made prior to Mineral Lands Leasing Act of 1920.
Validity uncertain or being contested.

OIL SHALE MINING CLAIMS

Figure III-1

CHAPTER III

ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

The alternatives analyzed in this document are all reasonable and implementable alternatives to resource management. No extreme or unreasonable options were considered for any resource, and no proposals were made for alternatives that could not be realistically implemented, even though they may have been raised as issues at the outset of the process. For example, it was recommended by members of the public that a National Wildlife Refuge be established for the Piceance Basin mule deer herd. This has been determined to be unreasonable, unnecessary and contrary to the Bureau's commitment to multiple-use management of the public lands. Similarly, a recommendation that all critical wildlife winter range be designated as Areas of Critical Environmental Concern, was not analyzed in detail, but rejected as not implementable within the management guidelines or intent of the Areas of Critical Environmental Concern program.

It was also determined at the outset of the process that a new study of the Piceance Basin range management program was unnecessary, and this was established as a planning criterion. The reason for this was that the *White River Grazing Management Environmental Impact Statement* was completed in 1981. This document established forage allocations for livestock grazing, wildlife and wild horses for the White River Resource Area, including the Piceance Basin. Rather than reanalyzing those allocations, slight modifications were proposed to accommodate the objectives of the alternatives, and the consequences to the range management program of implementing each alternative were identified.

Unlimited oil shale development and no oil shale development at all were considered to be unreasonable options for management. Instead, the maximum output option for oil shale was considered in the Oil Shale Alternative as constrained by critical environmental and socioeconomic factors. Similarly, in the minimum output option for oil shale described in the Wildlife Alternative, all constraints were placed on leasing, location, and development of oil shale that could reasonably be placed on a public resource. The result is a narrowed range of management options for oil shale development that does not include unrealistic extremes. This applies to all other resource management options as well.

CURRENT MANAGEMENT ALTERNATIVE

This alternative reflects the current management of the Piceance Basin and how it would continue to be managed under existing decisions and the Management Framework Plan that is currently in effect. The Current Management or "No Action" Alternative provides a baseline to compare the other alternatives. It includes a discussion of the demand, dependency and extent of implementation of each resource management value in the planning area.

In addition to the White River Management Framework Plan, several other documents and decisions are currently in effect and are being implemented in the Piceance Basin Planning Area. These are discussed briefly below and are referenced throughout the Current Management Alternative.

The Management Framework Plan (MFP) for the entire White River Resource Area has been in effect (with several amendments and updates) since 1975. It was updated comprehensively in 1980, but has subsequently been amended twice (for coal and wilderness). In 1980, a rangeland management program and environmental impact statement was completed, directing BLM's range program for the White River Resource Area. This statement identified the overall management of the grazing lands in the Piceance Basin, and directed the preparation of Allotment Management Plans to implement those decisions. The White River Resource Area is currently in the process of completing an environmental impact statement on wilderness management in the resource area. None of the Wilderness Study Areas identified in the inventory phase are located in the Piceance Basin Planning Area.

The White River Management Framework Plan was amended in 1981 to examine lands within the resource area which have high to moderate potential for coal mining. A determination was made on the suitability of these areas for further consideration for coal development. Approximately 47 square miles of lands within the Piceance Basin Planning Area east of Rangely were identified as suitable for the development of coal in the plan amendment. A comprehensive management program for oil and gas was established in 1981 for the White River Resource Area in an "umbrella" environmental assessment. The current process of approving applications for permit to drill, rights-of-way, exploration and development of oil and gas was formalized and made consistent in an effort to minimize surface disturbing activities caused by increased leasing.

Several resource-specific activity plans have also been completed. Presently completed plans include the Piceance Basin Habitat Management Plan, Naval Oil Shale Reserve Aquatic Habitat Management Plan, five Allotment Management Plans and the Piceance Basin Herd Management Area Plan for wild horses. Two additional plans scheduled for completion are the Timber Resource Management Plan and Fire Management Plan.

Throughout the preparation of these documents, the public has been invited to participate through scoping meetings, comments on draft documents, workshops and other mechanisms. The decisions made in these plans and environmental analyses are reflected in the Current Management Alternative and, to the extent consistent with the objectives of the other alternatives, through the Wildlife, Oil and Gas, Oil Shale and Preferred Alternatives.

AIR RESOURCE MANAGEMENT

The air resource management program limits air quality degradation by assuring the public land use activities comply with local, state and Federal laws, regulations and implementation plans. The program also supports other resource programs by providing basic climatic data and performing predictive modeling.

Existing conditions are monitored to determine changes associated with BLM or other agency activities. Future impacts are assessed prior to implementation and reviewed for compliance with existing laws and policies. Mitigation measures are incorporated into project proposals when necessary to reduce potential impacts. For example, air quality impacts from prescribed burns are limited by Manual Section 7723 (Air Quality Maintenance Requirements) which requires a state open burning permit prior to implementation.

Air resource management technical support is required from specialist in the Colorado Department of Health - Air Pollution Control Division, U.S. Environmental Protection Agency - Region VIII, BLM Colorado State Office and the Forest Service - Region II.

Resource Condition and Trend

The existing air quality in the planning area is generally good, but anticipated development will cause deterioration. The extent of this deterioration is limited by law, and will be caused by population impacts as well as industrial development.

Demand and Dependency

Maintenance of air quality is important to public health and welfare (local economies, aesthetics, etc.), but industrial growth and expanding populations consume the air resource through degradation. In certain locations potentially affected by activities in the planning area (particularly the Flat Tops Wilderness Area), the existing air quality is so clean that special legislation has been passed strictly limiting further degradation (PSD Class I and Colorado Category I increments). While the Bureau's ability to minimize impacts due to population growth is limited, careful *budgeting* of industrial sources will ensure balanced growth with minimal impacts.

MINERAL ACTIVITY

The management of public minerals is separated into three basic categories: leasable, locatable and saleable. The Mineral Lands Leasing Act of 1920 authorized that deposits of oil shale, oil, gas, coal, phosphate, sodium, potassium, asphalt and tar sands may be acquired only by a leasing system. Public lands with a known valuable leasable mineral are available through a competitive leasing system. Lands of unknown oil and gas potential are available through noncompetitive leasing.

Locatable minerals subject to the General Mining Law of 1872 include such minerals as gold, silver, copper, lead, molybdenum and uranium. In actuality, any mineral other than leasables and saleables, found on public lands in sufficient quality and quantity to make the lands valuable for that mineral may be subject to the General Mining Law. Locatable minerals may be staked and filed on open public lands by any qualified claimant.

Saleable minerals authorized by the Materials Act of 1947, as amended in 1955, include common varieties of sand, gravel, stone, pumice, pumicite, cinders and clay. These mineral materials may be disposed of by competitive sale or negotiated sale. In addition, free use permits for mineral materials are issued to other government agencies for public projects, as prescribed by 43 CFR 3600.

Mineral development within the Piceance Basin Planning Area is one of the most significant resource activities. The following discussion summarizes current mineral development and production within the Piceance Basin Planning Area.

CHAPTER III

Leasable Minerals

Oil Shale

Attempts to recover shale oil in the Piceance Basin have met with varying degrees of interest and success since the early 1900's. The Mineral Lands Leasing Act of 1920 enabled the Secretary of Interior to lease oil shale on Federal lands, provided that no lease tract exceeds 5,120 acres, an annual rental of 50 cents per acre is assessed, and that no individual or firm can hold more than this total acreage under Federal lease nationwide. Except for these provisions, the Secretary was given broad discretion to select lease tracts and develop lease terms.

The first successful effort by the Department of the Interior to lease oil shale began in the early 1970's with the Prototype Oil Shale Leasing Program. The goals of this program were established in 1973 by the Secretary of Interior. They are:

1. To provide a new source of energy to the Nation by stimulating the development of commercial oil shale technology by private industry;

2. To ensure the environmental integrity of the affected areas and at the same time develop a full range of environmental safeguards and restoration techniques that will be incorporated into the planning of a mature oil shale industry, should one develop;

3. To permit an equitable return to all parties in the development of this public resource; and

4. To develop management expertise in the leasing and supervision of oil shale development in order to provide the basis for future administrative procedures.

The initial prototype program was designed with the concept that six lease tracts in three states (Colorado, Utah and Wyoming) would be developed with significantly different mining and processing technologies, and that commercial-scale production of about 250,000 barrels per day (bbls/day) would be achieved by 1980. However, the Wyoming leases were not sold, and development of the Utah tracts was suspended due to legal ownership questions. Development has only recently resumed in Utah, postponing production plans by several years.

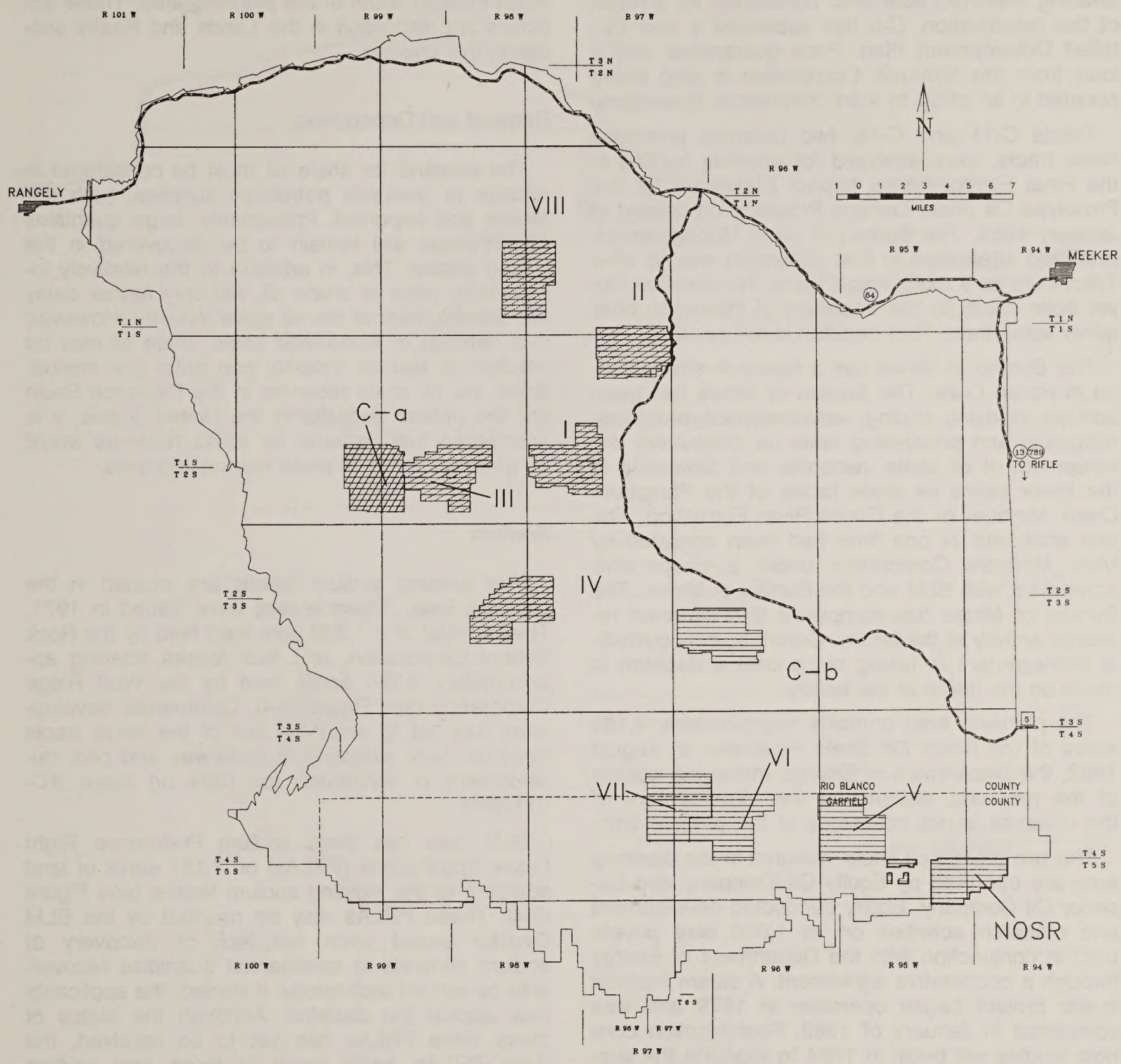
Of the prototype leases that were issued in 1974, two are located within the Piceance Basin Planning Area -- Tracts C-a and C-b. Current oil shale management would be to manage these existing oil shale tracts, and to continue the prototype program until the goals and objectives of that program are met. Should there be a demand for more opportunity to develop oil shale, future lease tracts would be limited to those tracts identified in the Management Framework Plan and would encourage multiple mineral development. Eight tracts have been identified and ranked in the order in which they should be offered for lease. These tracts would be offered under the prototype or permanent oil shale leasing programs to develop new mining technology as the current prototype leases are developed. Tract C-11, currently under consideration for leasing under the prototype program, is ranked as number one in the White River MFP. The eight tracts are shown on the Current Management Alternative map in the Map Addendum and on Figure III-2.

New oil shale leases would be grouped or adjacent to existing prototype tracts in order to concentrate impacts from development. No decisions have been made for off-tract spent shale disposal, so applications for such leases would be treated based on existing law 30 USC 241 which provides that not more than two offsite leases of not more than 320 acres each may be issued to developers of non-Federal lands after consideration of the need for such lands, impacts on the environment and other resource values, and upon a determination that the public interest will be served thereby. In addition, one 6,400 acre offsite lease may be issued to the holder of Federal Oil Shale Tract C-a.

Oil shale land exchanges would be considered based on criteria established in existing regulations on a case-by-case basis. Research tracts could be issued as provided for under current laws and regulations.

Colorado lease Tract C-a, held by the Rio Blanco Oil Shale Company, originally proposed an open pit mine with aboveground retorting. They planned to dispose of the processed shale off-tract. Subsequent to leasing, the Department of the Interior determined that it lacked adequate authority to lease surface use of offsite lands. C-a then switched to an experimental modified in-situ process which was successfully tested in 1981-1982. However, it was determined that the original open pit mining and surface retort proposal would provide for a more economic return and more efficient recovery of the resource as required by Federal regulations incorporated into the lease. The lease terms were suspended in August 1982, awaiting approval to lease off-tract acreage for spent shale disposal to accommodate an open pit mine.

Tract C-b is leased to the Cathedral Bluffs Shale Oil Company. They originally proposed an underground mine with aboveground retorting. As development progressed, it was discovered that the shale may be too fractured to allow for the extraction of economic quantities of oil shale. Their plans were then changed to a modified in-situ process. C-b has also significantly slowed development oper-



Roman numeral designations refer to tract ranking in White River MFP.

LANDS AVAILABLE FOR OIL SHALE LEASING CURRENT MANAGEMENT ALTERNATIVE

Includes existing leases (C-a and C-b) and the Naval Oil Shale Reserve (NOSR).

Figure III-2

ations while evaluating engineering feasibility and awaiting improved economic conditions. As a result of the reevaluation, C-b has submitted a new Detailed Development Plan. Price guarantees and a loan from the Synfuels Corporation is also being pursued in an effort to start commercial operations.

Tracts C-11 and C-18, two potential prototype lease tracts, were analyzed for possible leasing in the Final Environmental Impact Statement for the Prototype Oil Shale Leasing Program, completed in January 1983. The Bureau of Land Management's preferred alternative in that document was to offer Tract C-11 as a multimineral lease. No decision has yet been made by the Secretary of Interior to offer either lease tract. That decision is still pending.

The Bureau of Mines has a research shaft located in Horse Draw. The Bureau of Mines has been actively studying mining, environmental problems, mitigation and processing tests for concurrent development of oil shale, nahcolite and dawsonite in the lower saline oil shale facies of the Parachute Creek Member of the Green River Formation. The test shaft site at one time had been operated by Multi Minerals Corporation under a cooperative agreement with BLM and the Bureau of Mines. The Bureau of Mines has completed their planned research activity at the facility. Currently, only custodial management is taking place until a decision is made on the future of the facility.

The planning area contains approximately 4,160 acres of the Naval Oil Shale Reserves. In August 1982, the Department of Energy, managing agency of the reserves, determined that development of the reserves is not necessary at the present time.

The two private oil shale ventures in the planning area are operated by Equity Oil Company and Superior Oil Company. Equity conducted development and research activities on its 1,000 acre private tract in conjunction with the Department of Energy through a cooperative agreement. A steam injected in-situ project began operation in 1979 and was completed in January of 1983. Post-injection core hole studies will begin in 1984 to evaluate the success of the injection process.

Superior Oil Co. has approximately 6,000 acres in the northern part of the planning area which contain oil shale and sodium minerals. Superior had proposed a multimineral underground mine with an aboveground multi-product recovery unit. In 1973, Superior requested a land exchange with BLM to block up a logically shaped mining unit. This exchange was denied as being unequal in land and resource value for lands offered.

The location of the tracts is shown in Figure III-3.

Additional management activities related to oil shale are the lands and realty actions which support private development in the basin and on the Roan Plateau south of the planning area. These activities are discussed in the Lands and Realty section in this chapter.

Demand and Dependency

The demand for shale oil must be considered in relation to available petroleum supplies, both domestic and imported. Presumably, large quantities of petroleum still remain to be discovered in the United States. This, in addition to the relatively inexpensive price of crude oil, will only further delay the development of the oil shale industry. However, in a national or world-wide crisis, shale oil may be needed as fast as industry can enter the market. Since the oil shale reserves in the Piceance Basin are the richest deposits in the United States, it is anticipated that demand for these reserves would be great once the oil shale market improves.

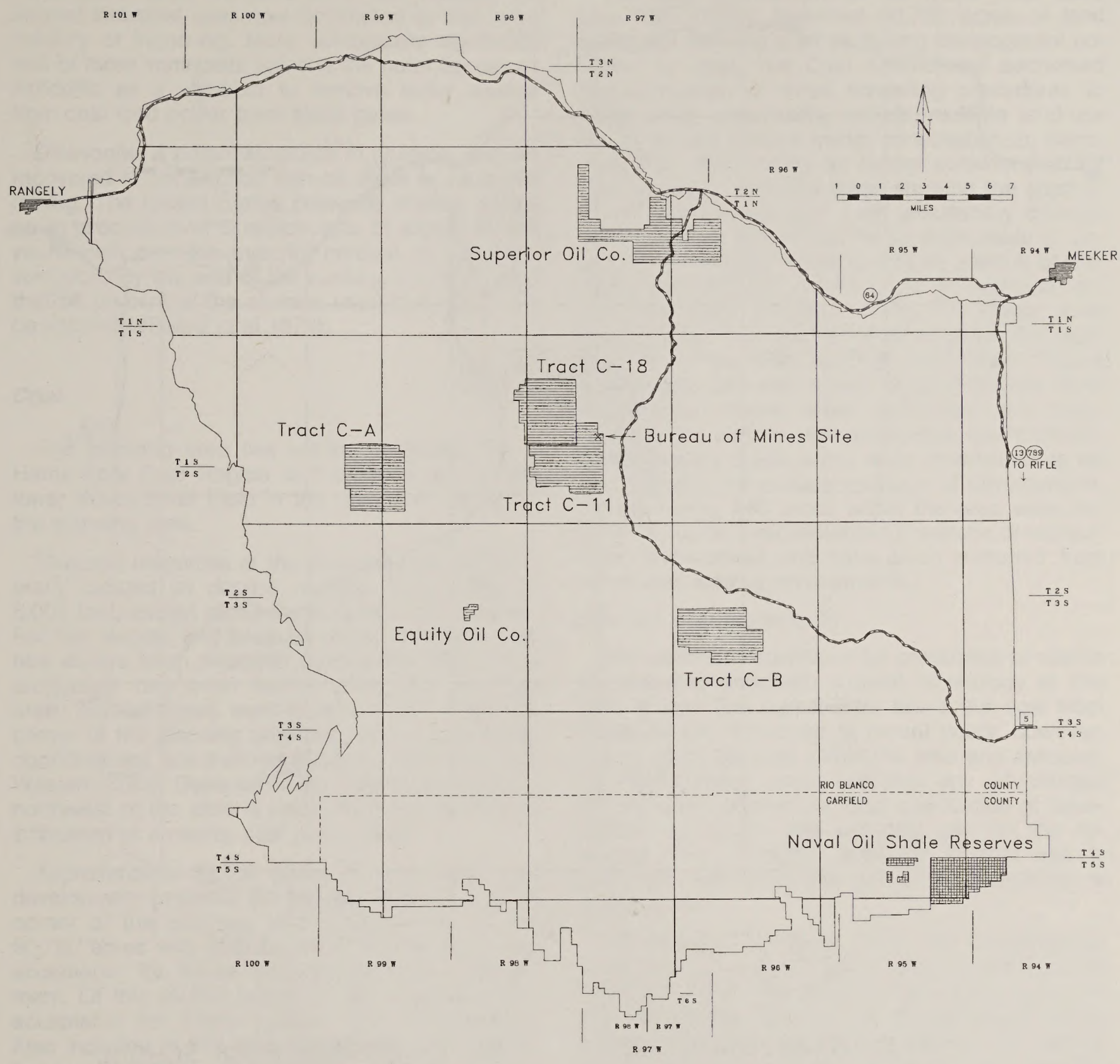
Sodium

Five existing sodium leases are located in the planning area. These leases were issued in 1971. They consist of a 1,320 acre tract held by the Rock School Corporation, and four leases totalling approximately 8,360 acres held by the Wolf Ridge Corporation (see Figure III-4). Commercial development has yet to occur on any of the lease tracts however, bulk sampling is underway and pilot development is scheduled for 1984 on lease #C-0119886.

BLM also has three sodium Preference Right Lease Applications (PRLAs) on 7,157 acres of land adjacent to the existing sodium leases (see Figure III-4). These PRLAs may be rejected by the BLM Director based upon the lack of discovery of sodium minerals in commercial quantities recoverable by current technology. If denied, the applicants may appeal the decision. Although the status of these three PRLAs has yet to be resolved, the three PRLAs could result in three new sodium leases capable of supporting two sodium mines. If the PRLAs are denied, these lands would return to multiple use management.

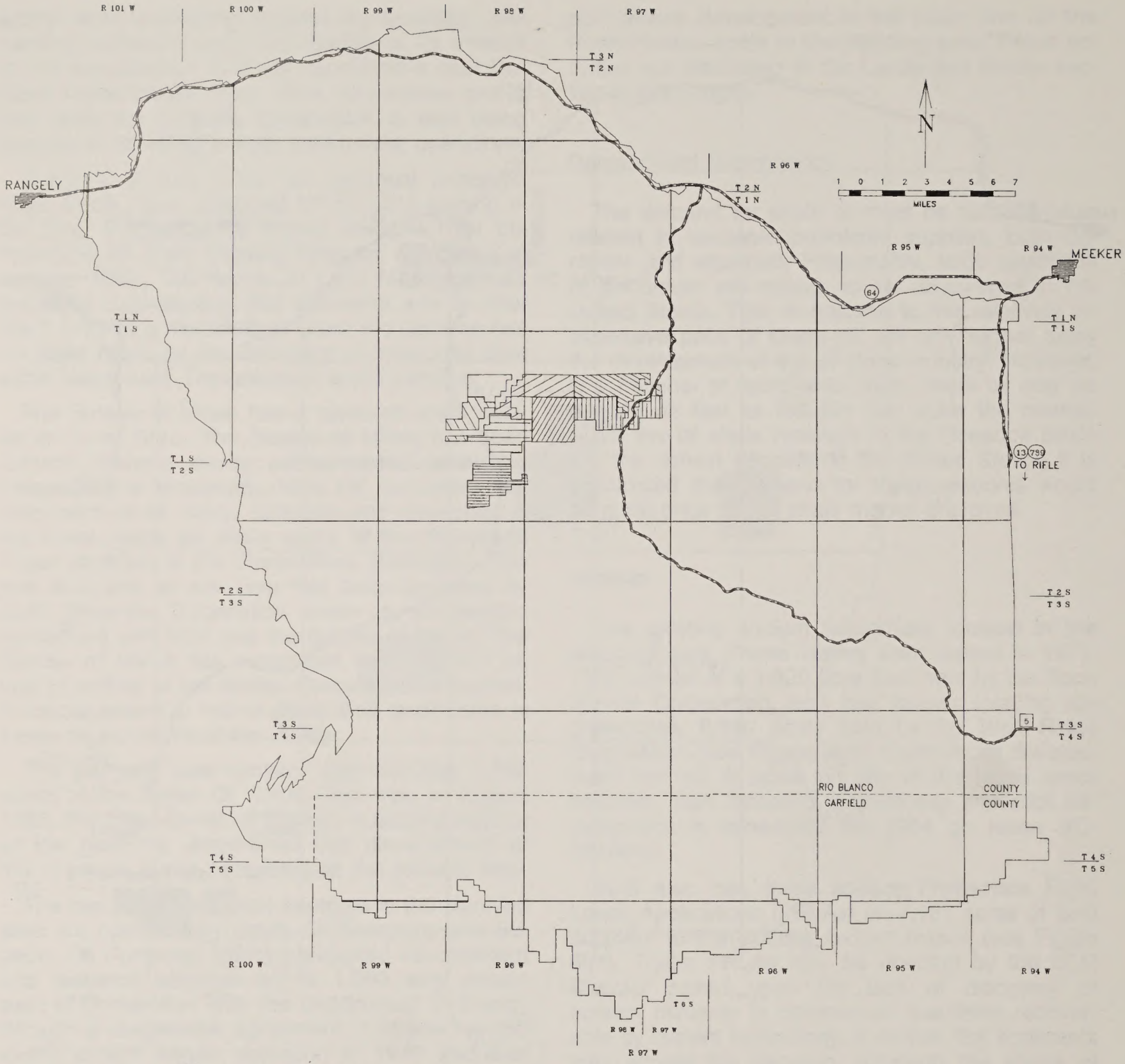
All of these tracts are located near the depositional center of the Piceance Basin where oil shale as well as sodium minerals (nahcolite, dawsonite and halite) are the richest. Future BLM management of these lands is not likely to include leasing for sodium minerals only, until the existing leases are developed. However any future sodium mineral leasing, will emphasize the development of oil shale and sodium minerals concurrently.

Demand and Dependency



LOCATION OF PUBLIC AND PRIVATE
OIL SHALE ACTIVITIES

Figure III-3



C-0118326 WOLF RIDGE

C-0118327 WOLF RIDGE

C-0119986 WOLF RIDGE

C-37474 WOLF RIDGE

C-0119985 ROCK SCHOOL

C-0118329 PRLA

C-00118328 PRLA

C-0120057 PRLA

LOCATION OF THE SODIUM LEASES AND PREFERENCE RIGHT LEASE APPLICATIONS (PRLA)

Figure III-4

Nahcolite could be used as a raw material for several industrial uses now dominated by the trona industry of Wyoming. More ecologically significant and of more immediate value is the potential use of nahcolite as a scrubber to remove sulfur dioxide from coal fired power plant stack gases.

Dawsonite, a potential source of alumina, may be recovered in conjunction with oil shale or nahcolite mining. The United States presently imports alumina to produce over 5 million tons of aluminum per year which provides over 90 percent of U.S. consumption. By the end of the century, it is estimated that 98 percent of the alumina used in the U.S. will be imported (Beard et al 1974).

Coal

The planning area lies within the Green River-Hams Fork Coal Region and includes part of the lower White River Field in the northwest corner of the planning area.

The coal resources of the planning area are generally located at depths ranging from 3,000 to 6,000 feet, except along the periphery of the basin. For this reason, and because more accessible coal has always been available outside the basin, coal production has been limited within the planning area. Several mines were located in the northwest corner of the planning area but none are presently operating nor are their production records known. Western Fuels' Deserado mine located immediately northwest of the area is presently being developed in support of a nearby coal power plant.

Approximately 30,780 acres of lands with coal development potential are located in the northwest corner of the planning area (Figure III-5). Of the 30,780 acres with coal potential, 29,610 acres are acceptable for future underground coal development. Of this 29,610 acres, 24,635 acres are also acceptable for future surface coal development. Also included in this area are portions of two coal leases (C-028875, C-0126669) totalling approximately 800 acres. Presently there are no plans to lease additional tracts within the planning area except for lands adjoining existing leases.

Acceptability of Coal Development

The Bureau of Land Management, under the Surface Mining Control and Reclamation Act of 1977, is required to review Federal lands through land use planning assessments to determine the acceptability of those Federal lands for all or certain stipulated methods of coal mining. Bureau methods for assessing acceptability are defined in the planning regulations (43 CFR 1610.7-1) and the coal regulations (43 CFR 3461).

The Coal Amendment to the White River Land Use Plan (1981), identified 30,780 acres of land within the planning area as having development potential for coal. The Coal Amendment addressed the application of three screening procedures to these lands--unsuitability criteria, multiple land-use decisions and surface owner consultation--to determine their acceptability for further consideration for coal leasing. It includes maps showing the application of each screen and each unsuitability criterion and the areas determined to be acceptable or unacceptable for coal development as a result of that application. Copies of the Coal Amendment are available from the White River Resource Area office. Figure III-5 shows the area within the planning area covered in the Coal Amendment. Figure III-6 summarizes the results of applying the three screens and shows areas acceptable and unacceptable for surface and subsurface development. Approximately 5,358 acres were determined to be unacceptable for surface methods of development. Approximately 380 acres within the area were determined to be unacceptable for surface or subsurface development and have been excluded from future coal leasing consideration.

Demand and Dependency

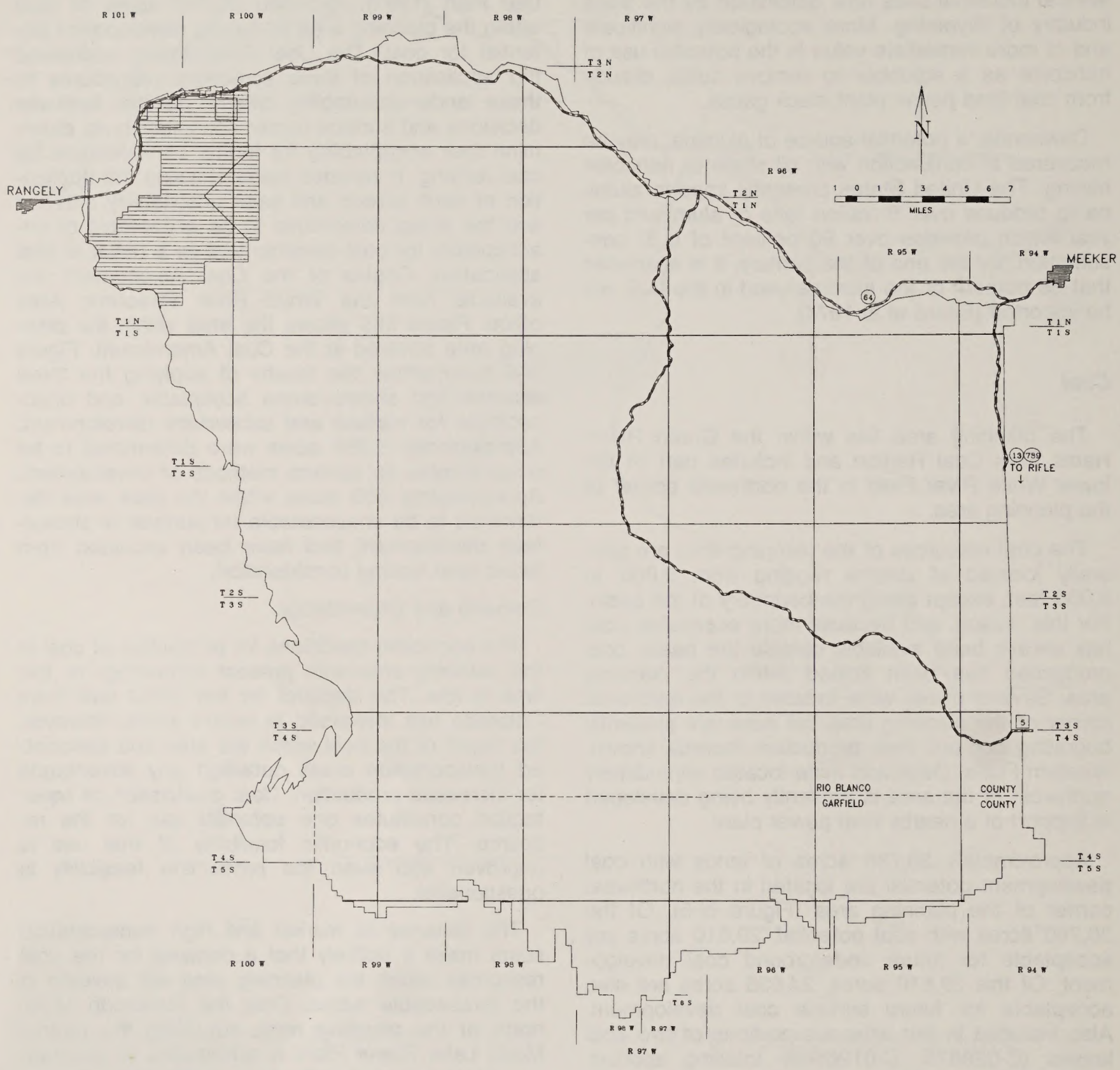
The economic conditions for production of coal in the planning area with present technology at this time is low. The demand for low sulfur coal from Colorado has increased in recent years; however, the depth of the coal within the area and associated transportation costs outweigh any advantages for increased production. Coal gasification or liquefaction constitutes one potential use for the resource. The economic feasibility of that use is unproven and even the production feasibility is questionable.

The distance to market and high transportation costs make it unlikely that a demand for the coal resources within the planning area will develop in the foreseeable future. Only the Deserado Mine, north of the planning area, supplying the nearby Moon Lake Power Plant is anticipated to generate any interest in coal in the area, and sufficient quantities exist closer to the existing mine to preclude demand in the planning area.

Oil and Gas

Oil and gas production has been and remains the most significant mineral activity within the Piceance Basin Planning Area.

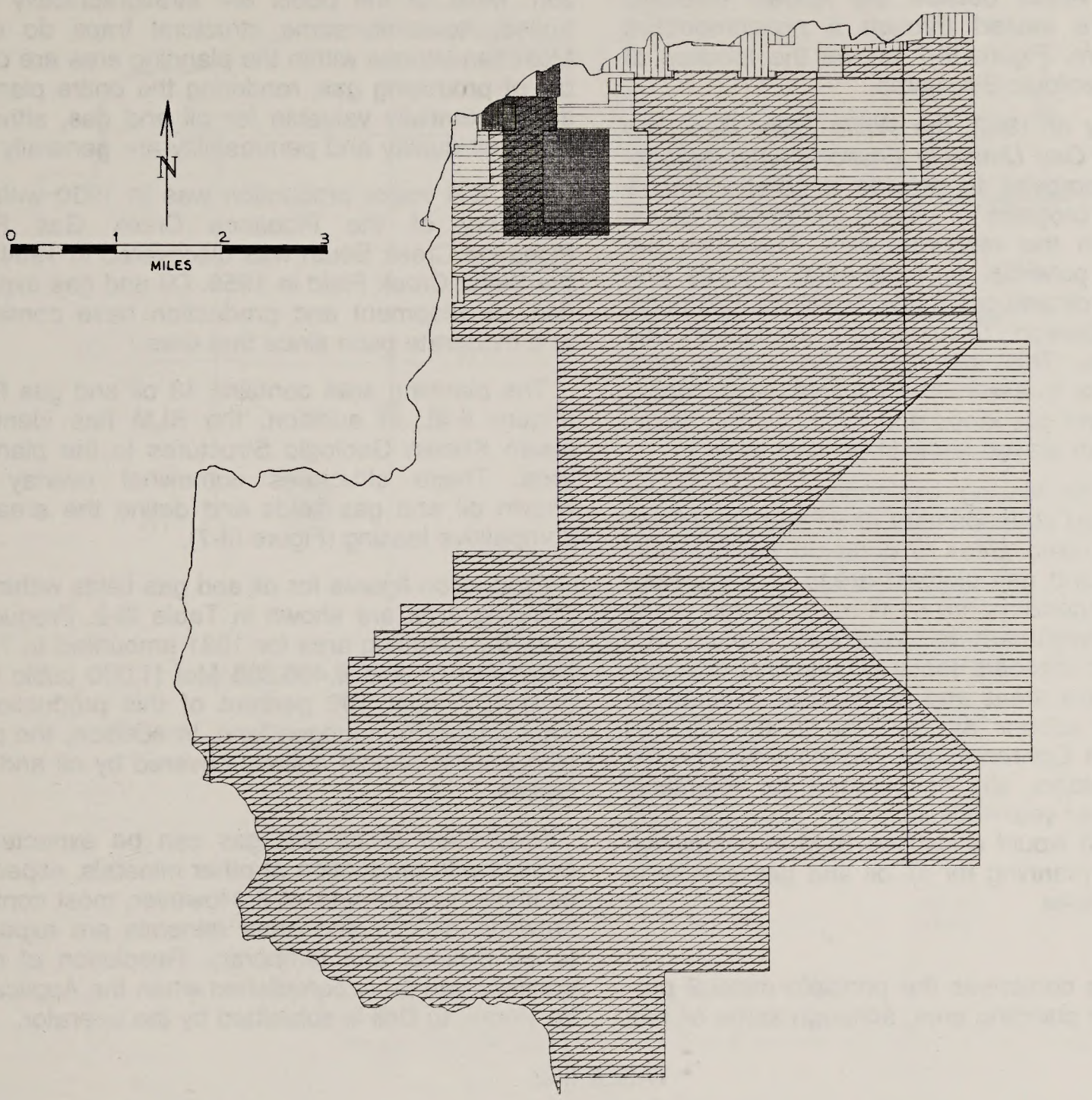
Oil and gas resources under Federal management are made available through a leasing system, as mandated by the Mineral Lands Leasing Act of 1920. When the resources are located within a



POTENTIALLY RECOVERABLE COAL RESOURCES

LOCATION OF POTENTIALLY RECOVERABLE COAL RESOURCES

Figure III-5



LANDS WITH POTENTIAL FOR COAL DEVELOPMENT, ACCEPTABLE FOR FURTHER CONSIDERATION FOR SURFACE AND UNDERGROUND MINING, AND THE EXISTING COAL LEASES

Figure III-6

Known Geologic Structure, they are leased by competitive bid. Areas outside the Known Geologic Structures are leased through a noncompetitive leasing system. Figure III-7 shows the location of the Known Geologic Structures.

In February of 1982, the *White River Resource Area Oil and Gas Umbrella Environmental Assessment* was approved to provide a comprehensive management program for oil and gas mineral development within the resource area. This plan addresses the potential environmental impacts and mitigation for oil and gas roads, pipelines, drill pads, leasing, exploration, development, production and abandonment. This comprehensive assessment was necessary to assure the multiple use management of oil and gas lands and influence the development of prior leased lands in positive ways.

Presently, the leasing, exploration, development, production, and abandonment of oil and gas minerals in non-unitized areas is done on an individual basis. In oil and gas unitized areas in a development stage, operators are required to submit yearly plans of development for approval. Impacts are mitigated with standard lease stipulations, designation of no lease areas and site-specific stipulations for individual actions as specified in the Oil and Gas Umbrella Environmental Assessment. However, lease holders are encouraged to voluntarily submit a five year development plan for their lease(s) which would assist the BLM in cumulative development planning for all oil and gas activity in the resource area.

Production

Natural gas comprises the principle mineral production of the planning area, although some oil has been obtained from almost every producing horizon. Most of the pools are stratigraphically controlled; however, some structural traps do exist. Most sandstones within the planning area are capable of producing gas, rendering the entire planning area potentially valuable for oil and gas, although reservoir quality and permeability are generally low.

The first major production was in 1930 with the discovery of the Piceance Creek Gas Field. Piceance Creek South was discovered in 1954 and the Sulfur Creek Field in 1959. Oil and gas exploration, development and production have continued at a moderate pace since that time.

The planning area contains 13 oil and gas fields (Figure II-6). In addition, the BLM has identified seven Known Geologic Structures in the planning area. These structures somewhat overlay the known oil and gas fields and define the areas of competitive leasing (Figure III-7).

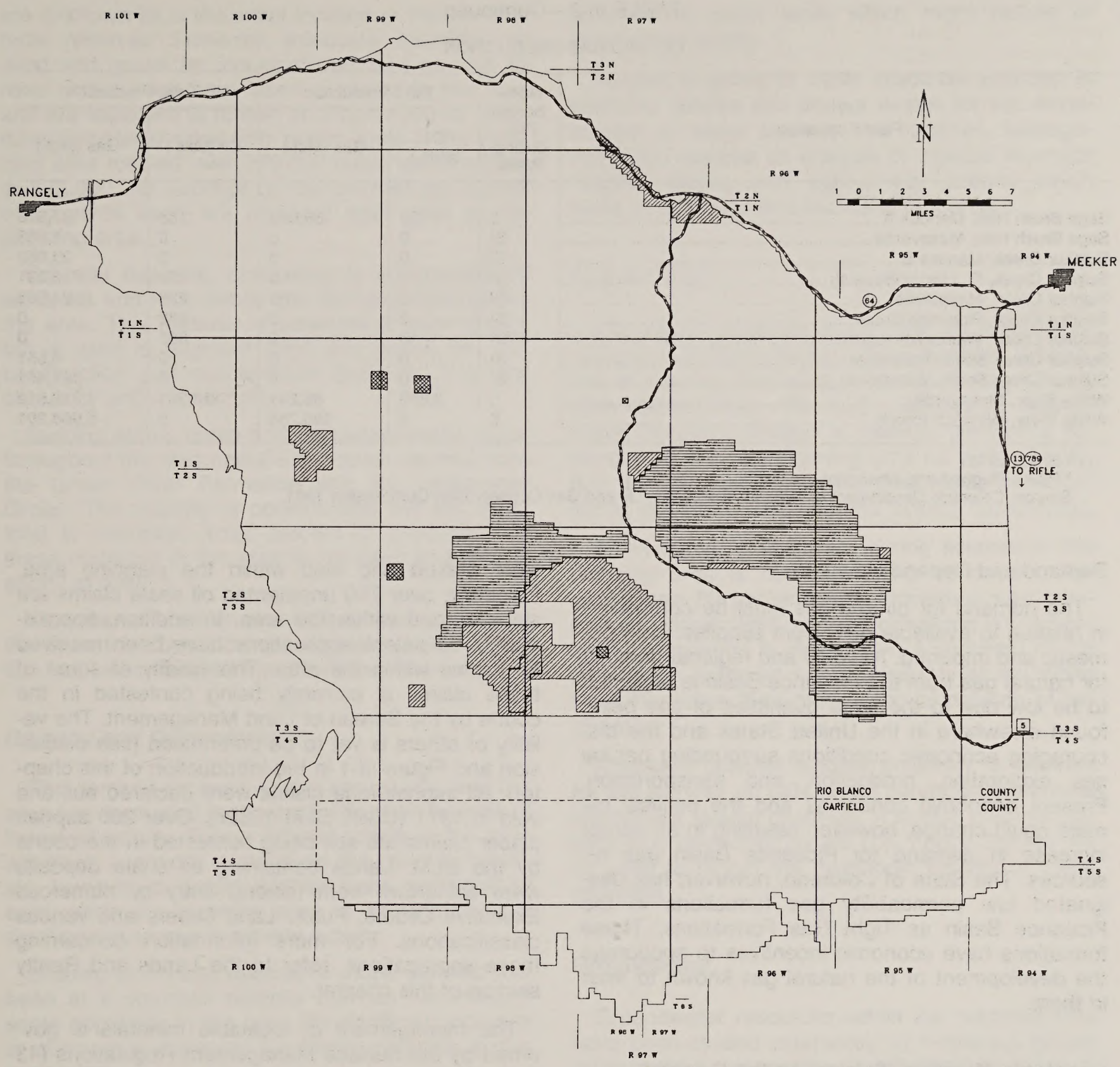
Production figures for oil and gas fields within the planning area are shown in Table III-2. Production from the planning area for 1981 amounted to 7,083 barrels of oil and 6,406,368 Mcf (1,000 cubic feet) of gas. Almost 100 percent of this production is from Federally managed land. In addition, the planning area is almost entirely covered by oil and gas leases.

Production of oil and gas can be expected to conflict with production of other minerals, especially oil shale, sodium and coal. However, most conflicts between oil/gas and other minerals are expected to be minimal and temporary. Resolution of most conflicts can be accomplished when the Application for Permit to Drill is submitted by the operator.

TABLE III-2

OIL AND GAS PRODUCTION

Field-Formation	Number of Producing Wells	1981 Production		Total Production	
		Oil (bbls.)	Gas (Mcf.)	Oil (bbls.)	Gas (Mcf.)
Corral Creek, Dakota	2	68	63,662	68	63,662
Corral Creek, Dakota/Morrison	1	0	180,564	23	274,749
Corral Creek, Mancos B	2	231	62,904	484	144,661
Piceance Creek, Douglas Creek	11	0	287,768	0	51,431,361
Piceance Creek, Douglas Creek/Wasatch	1	0	2,227	0	340,389
Piceance Creek, Mesaverde	2	1,458	175,569	8,666	1,334,363
Piceance Creek, Wasatch A	31	647	3,917,535	7,207	67,453,004
Piceance Creek, Wasatch D	SI[1]	0	0	0	366,400
Piceance Creek, Wasatch F	2	77	84,187	397	560,536
Piceance Creek, Wasatch G	5	552	987,097	100,989	61,424,197
Piceance Creek South, Douglas Creek	1	0	24,122	450	2,210,798
Powell Park, Fort Union	P&A [2]	0	0	189	251,532
Powell Park, Mesaverde	P&A	0	0	3,102	16,354
Powell Park, Mancos B	1	0	1,464	0	7,376
Powell Park, Wasatch	P&A	0	0	1,016	0



KNOWN GEOLOGIC STRUCTURES

Figure III-7

TABLE III-2—Continued

OIL AND GAS PRODUCTION

Field-Formation	Number of Producing Wells	1981 Production		Total Production	
		Oil (bbls.)	Gas (Mcf.)	Oil (bbls.)	Gas (Mcf.)
Sage Brush Hills, Mancos A	2	152	35,683	188	67,989
Sage Brush Hills, Mesaverde	SI	0	0	0	1,063
Sulphur Creek, Mancos B	SI	0	0	0	23,852
Sulphur Creek, Ft. Union/Wasatch	SI	0	0	122	3,031
Sulphur Creek, Mesaverde	SI	0	706	229	24,025
Sulphur Creek, Piceance Creek	SI	0	0	583	0
Sulphur Creek, Wasatch	P&A	0	0	865	0
Sulphur Creek South, Parachute	SI	0	0	0	6,551
Sulphur Creek South, Wasatch G	SI	0	0	0	391,461
White River, Mesaverde	5	3,898	83,291	16,301	1,318,612
White River, Wasatch (con't)	6	0	490,755	0	5,968,301

[1] SI - Shut In.
[2] P&A - Plugged and Abandoned.
Source: Colorado Department of Natural Resources, Oil and Gas Conservation Commission 1981.

Demand and Dependency

The demand for oil and gas must be considered in relation to available petroleum supplies, both domestic and imported. National and regional demand for natural gas from the Piceance Basin is expected to be low due to the large quantities of gas being found elsewhere in the United States and the discouraging economic conditions surrounding natural gas exploration, production, and transportation. Present economic conditions and the political climate could change, however, resulting in an abrupt increase in demand for Piceance Basin gas resources. The State of Colorado, however, has designated low permeability gas formations in the Piceance Basin as Tight Gas Formations. These formations have economic incentives to encourage the development of the natural gas known to exist in them.

Locatable Minerals (Subject to the General Mining Law of 1872)

Being predominately a sedimentary structure, the Piceance Basin Planning Area is not noted for areas of magmatic, metamorphic or hydrothermal mineralization. Sedimentary deposits of uranium-vanadium, limestone-dolomite and gypsum are found within the planning area, but are not considered economically recoverable at this time. Consequently, no locatable minerals are currently being produced from the planning area. However, prior to the Mineral Lands Leasing Act of 1920, all minerals were considered locatable. As a result, thousands of oil shale claims (USDI, BLM 1982d) as well as hundreds of asphalt claims (USDI, BLM 1982c) were staked and filed within the planning area. Presently, over 750 unpatented oil shale claims are still recorded within the area. In addition, approximately 25 patent applications have been received for claims within the area. The validity of some of these claims is currently being contested in the courts by the Bureau of Land Management. The validity of others is yet to be determined (see discussion and Figure III-1 in the introduction of this chapter). All asphalt lode claims were declared null and void in 1971 (USDI, BLM 1982c). Over 200 asphalt placer claims are still being contested in the courts by the BLM. Lands containing oil shale deposits were withdrawn from mineral entry by numerous Executive Orders, Public Land Orders and various classifications. For more information concerning these segregations, refer to the Lands and Realty section of this chapter.

The management of locatable minerals is governed by the Surface Management Regulations (43 CFR 3809) which provide for the management and reclamation of all lands subject to the General Mining Law of 1872.

Saleable Minerals

Common varieties of mineral materials occurring within the planning area include significant deposits of sand, gravel, building stone, riprap, decorative stone and clay.

Sand and gravel deposits within the planning area occur primarily along the White River and its tributaries. Numerous pits can be found on both private and public lands in the area. Total reserves

are unknown as is the exact location of mineral material reserves. However, adequate quantities of sand and gravel for industrial purposes as well as road construction have been available in the past and are expected to remain so. From 1980 to 1982, mineral material sales from public lands in the planning area totalled over 270,000 cubic yards valued at $73,000. An average of four permits for 70,000 cubic yards each are received each year in the planning area.

Colluvial deposits, consisting of unconsolidated sand, silt and rock debris can be found throughout the area. This material is generally of poor quality but is used to augment sand and gravel for road construction and maintenance because of its accessibility and abundance.

Building stone, riprap and decorative stone occur throughout the area and are principally derived from the Green River Formation and the Mesaverde Group. The quantity is considerable but the exact total is unknown. Total amount of production of these materials in the area is unknown and data is spotty at best.

Clay deposits within the Mesaverde Group and the Wasatch Formation are extensive. No production has been reported from the area, however.

Demand and Dependency

The demand for sand, gravel and pit run from the area has fluctuated in the past with short periods of industrial activity. Future mineral activity in the area will place a greater demand on the mineral materials; however, sufficient quantities are estimated to exist within the planning area to accommodate a significant increase in mineral activity.

Building stone and decorative stone demand has been at a standstill recently but has experienced some popularity in the past. No significant increase in demand is expected for these materials in the near future.

The demand for riprap within the area has been limited, although some has been used locally on roads.

No clay has been produced from the area nor is any expected unless a market develops.

WATER RESOURCES

The present management of water resources in the Piceance Basin Planning Area is limited to maintaining water quality at existing levels. For the most part, this consists of applying stipulations to activities on public lands which might pollute or lower water quality.

Support is given to other resource activities in feasibility studies and project design for the development of water sources and facilities. Management also requires an analysis of impacts on major Federal leasing and right-of-way actions which could potentially affect the water resource.

Surface Water

The current program is primarily an ongoing inventory of surface waters, which includes a baseline of sources, flow data, water quality and floodplain delineations. The U.S. Geological Survey, Water Resource Division is currently monitoring numerous sites in the planning area for water quality, flow data, and sediment yield, (this varies with monitoring site instrumentation and funding capabilities).

An inventory of locatable spring sources in the planning area is currently being conducted. Approximately 80 percent of the inventory was completed in fiscal 1983, and the remaining 20 percent will be completed in fiscal 1984. A summary of the information gathered will be available at the White River Resource Area office upon completion of the inventory.

A stream channel stability inventory is planned for the summer of 1984 on all perennial and critical intermittent stream channels. A stream channel stability form developed by the U.S. Forest Service will be used to record the hydrologic stability of these channels.

Groundwater

Groundwater resources within the planning area have been studied extensively by numerous private organizations, universities and Federal government agencies. The Bureau's main management objective in relation to groundwater is to maintain and ensure the integrity of the present aquifer system both in quantity and quality throughout the Piceance Basin and surrounding areas. Mineral development (oil shale, sodium and possibly coal) has the greatest potential to impact groundwater resources in the basin.

Groundwater has been developed and is used by private industry, ranching operations and by the Bureau for range and wildlife management. In addition, numerous monitoring projects are currently underway within the planning area by both private industry and Federal agencies.

Water Management Regulations

Several regulations govern and affect water management. At the local level, the Associated Governments of Northwest Colorado has completed their 208 Water Management Plan. This could mandate some water quality controls for the public lands, but the plan is presently under a court injunction while future planning and refinement is determined.

The State of Colorado has classified and set numeric standards for streams and standing bodies of water. The Bureau's water quality management practices will be dependent upon these standards. By adhering to the State's standards, the Bureau would also meet the requirements of the Federal Water Pollution Control Act, the Colorado River Basin Salinity Control Act and the Clean Water Act.

Water Rights

The Bureau has filed applications for numerous water sources in the planning area. Reserved water rights claims for 153 springs in the area were filed as part of the general state adjudication of 1972. In addition, applications for 19 wells were made by the Bureau as a part of that adjudication. Since 1972, many new springs have been identified and other numerous new water facilities have been developed. In accordance with State law, the Bureau filed for appropriation rights for springs, wells and stock water reservoir storage rights between 1972 and 1983.

Public water reserves are springs and water holes that were reserved by the U.S. Government by executive order in 1926 for domestic and livestock water supplies. The purpose was to prevent monopolization of large tracts of arid grazing land by the control of water sources.

Demand and Dependency

Two major demands on water resources presently exist within the planning area. Local demand for irrigation and domestic water along with wildlife and livestock usage competes with industrial interests. This surface water use is highly dependent upon the groundwater discharge which supplies 80 percent of the annual runoff (18,000 acre feet) of the basin (Weeks et al 1974).

Runoff from the basin is affected by irrigation diversions and consumptive use by crops, native vegetation, evaporation and livestock and wildlife use. Streamflow depletions resulting from irrigation demand is approximately 5,000 acre ft/yr.

Ranching operations in the planning area remain in a somewhat static condition in relation to water use, however, as energy development continues to increase, competition for surface flow throughout the Piceance Basin will remain a major area of concern. The social values associated with water resources in the planning area involve retaining natural flow and quality conditions for ranching operations while still providing water needs for the anticipated industrial growth within the basin.

SOILS

It is Bureau policy to protect, maintain or improve the quality of the soil resource. The objectives of the soil program are to impede deterioration of soil conditions and to stabilize and rehabilitate areas where accelerated erosion and runoff have resulted in unacceptable resource conditions.

The soil resource is the basis for all biological production. It is also the construction material for roads, drill pads, foundations, pits and reservoirs. During pre-project planning and investigations, detailed soil maps are used and soil properties are analyzed to determine soil productivity potential and engineering suitability. Onsite soil investigations are used to make specific recommendations on project locations. Areas with high wind and water erosion susceptibility, saline soils and especially steep, clayey slopes are avoided. Reclamation measures are stipulated to maintain soil productivity and stability.

Resource Condition and Trend

Soil resource condition and trend appear to be slowly improving throughout the planning area due to improving vegetation conditions from recent management practices. Soil management efforts on energy related activities are directed to locating sites on stable areas and avoiding erosive sites. This has slightly reduced the amount of erosion and sedimentation.

Demand and Dependency

The demand for vegetation production for livestock and wildlife objectives results in an increased emphasis on soil productivity. Soil disturbance associated with energy development places a greater demand on undisturbed sites and increases the need for acceptable soil management practices on these sites.

FORESTRY

The forest resources of the planning area include Douglas fir sawtimber, pinyon Christmas trees, juniper fenceposts and pinyon/juniper firewood. Locations of forest and woodland stands are shown on surface cover type maps which were developed from interpretation of infrared aerial photographs. These maps are available for review at the White River Resource Area office.

Management of forest resources is implemented primarily through the sale of forest products. This is accomplished through advertised and negotiated commercial sales, and individual negotiated sales of all forest products. In 1983, approximately 2,500 cords of pinyon-juniper firewood and 250,000 board feet of Douglas fir sawtimber are planned to be sold through commercial sales as identified in the White River Resource Area 5-year sale plan. Additional sales of products to individuals and commercial interests are anticipated, and are handled on a case-by-case basis.

Current management is based on decisions and directives from the existing Management Framework Plan for the White River Resource Area (USDI, BLM 1981) and Bureau-wide policy directives.

The current management objectives for sawtimber and pinyon-juniper woodlands are to manage, in perpetuity, these forested areas for a sustained annual yield. This objective is supported by a Management Framework Plan decision to develop and implement a forest management plan. The first step in preparing a management plan, which is locating, mapping and classifying timber stands, is currently underway.

Directives from the Woodland Management Policy Statement include recognizing woodlands as distinct ecosystems to be managed and perpetuated for the production of multiple resource values. These values include wood products, livestock forage, wildlife habitat, recreation uses, and watershed protection. Another directive is to develop and maintain an extensive inventory and classification of public woodlands. This information will be used to determine productive capabilities and to ensure an orderly harvest of available woodlands. Another desired goal of a woodlands program is to achieve a positive benefit/cost ratio.

Overmature, decadent, or stagnated stands of timber and woodlands can be returned to a productive status, through harvesting and allowing for regeneration in the sale design. The goal of perpetuating all forest and woodlands stands is gradually being achieved. Forage and browse species are also expected to increase in harvested areas and will improve livestock grazing and big game habitat. Care is taken during sale layout to protect raptor and cavity nesting sites. Overall, timber harvesting results in a trend toward improvement of forest, range, wildlife and watershed resources while generating funds to ensure the continuance of a forest management program.

Energy development within the planning area frequently requires clearing of forested areas. These include exploration and development operations for oil, natural gas, oil shale and coal, as well as the associated rights-of-way for roads, pipelines, and transmission lines.

Upon project approval, an appraisal is conducted using detailed maps and aerial photographs. Volumes and values of timber to be cleared are estimated and prices are set in the same manner as negotiated commercial timber sales. Project operators are required to purchase all timber at the appraised value prior to beginning the project.

Stipulations for timber disposal and rehabilitation of the site are included in all approved project documents. Currently, most of the development operations do not involve large-scale clearing of forested areas. Total disturbance is usually less than five acres with most one-half to two acres in size. Commercial forest acres of Douglas fir are seldom affected, since most energy developments are at the lower elevations where pinyon-juniper woodlands are usually involved. In the long run, forest management capabilities are assisted by energy development as a result of the increased construction of new roads for energy-related use.

Demand and Dependency

Local demand for Douglas fir sawtimber is almost entirely attributable to the only wood processing mill in Meeker. Although the mill purchases sawtimber from nearby U.S. Forest Service lands, Douglas fir on BLM land is generally closer and at lower elevations, thereby allowing longer work seasons. The mill requests a continuing supply of Douglas fir sawtimber from BLM lands, the majority of which will be harvested in the planning area. Future forest management plans will consider local mill demands for sawtimber when determining volumes to be offered for sale.

The local mill is the only sawtimber processing facility within 100 miles of the planning area. In recent advertised sales, no bids were received from other than the local mill.

Douglas fir is the preferred species of sawtimber for producing large dimension lumber and bridge planks. As a result, Douglas fir has a higher value than other sawtimber species at the mill.

CHAPTER III

Local demand for pinyon-juniper firewood is primarily from residents of Meeker, Rangely and Rifle who are cutting wood for personal use. The U.S. Forest Service also offers the opportunity for these residents to harvest firewood, however pinyon, the preferred species, is available only on BLM lands. BLM lands in the planning area are generally closer to the population centers and are more easily accessible during the winter months. At present, the supply of firewood far exceeds the local demand.

Commercial firewood cutters seeking pinyon are attracted to the planning area from the Denver, Grand Junction, Vail, Aspen, Craig and Steamboat Springs markets in response to the high quantity and quality of products located here. This regional demand, as well as dependency, is expected to increase in the future as suitable firewood cutting areas close to these urban centers become more difficult to find. Several other species are marketed as commercial firewood; however, pinyon is the most preferred, commanding a significantly higher price than other regionally harvested species.

Currently, the volumes offered through commercial firewood sales are based on the public demand. This determination is addressed on the basis of public inquiries and requests for forest products, outcome of past commercial firewood sales, and analysis of market conditions. In the future, with completion of a woodland inventory and preparation of a woodland management plan, an annual allowable harvest figure can be determined. This is necessary to determine the best methods for satisfying the public demand for forest products while insuring that a sustained yield from woodlands is perpetuated.

LIVESTOCK GRAZING

Current Management

Livestock grazing on public lands in the planning area involves 32 livestock operations on 34 allotments ranging in size from 764 to 156,091 acres. Twenty-nine are cattle allotments, five are sheep allotments and three operations run both cattle and sheep.

At present, five cattle allotments are intensively managed under Allotment Management Plans. These allotments cover approximately 40 percent of the area and utilize approximately 30 percent (20,820 AUMs) of the total AUMs of active use in the planning area. Of the remaining allotments, 24 were proposed for Allotment Management Plan implementation and five were to be less intensively managed as indicated in the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980). Allotment Management Plan implementation schedules as proposed in that statement were originally scheduled for completion by 1988. However, based on present funding levels, entire implementation may not be achieved until the year 2000.

Periods of use on public lands within the Piceance Basin are variable, depending on elevation, water availability and allotment size. Generally, the lower elevations are used for spring and winter range, the mid-elevation zones for summer/fall range. Some allotments are used on virtually a year-round basis while others are used only seasonally.

The earliest that grazing is permitted in the spring is March 1; however, spring use may be made as late as June 20 depending on allotment elevation. When available livestock forage or water is depleted, grazing use ceases and livestock are removed from the allotment or moved to higher elevation rangeland.

The majority of the public lands in the planning area (91 percent) are grazed by cattle with nearly equal amounts of use in all seasonal periods. Approximately 90 percent of this use occurs on allotments having continuous cattle use from spring through fall and on those having yearlong use. Consult the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980) for specific allotment use.

Sheep grazing occurs on nine percent of the public lands in the planning area, all of this use occurs on spring and fall ranges. Sheep operations in the planning area utilize the allotments in transition between BLM winter ranges in the Rangely Planning Unit and summer ranges on U.S. Forest Service lands.

Lambing normally occurs on both private and BLM lands while winter feeding, when necessary, occurs on private and state lands. Coyote predation is a major factor in determining the nature and extent of sheep use made within the planning area.

Allotments grazed by both cattle and sheep total three percent of the area.

Livestock trailing (principally sheep) in the planning area occurs on the White River Trail which lies west of Piceance Creek and immediately south of the White River extending to Rangely. The White River Trail, from the mouth of Piceance Creek to the mouth of Douglas Creek, includes 4,320 acres of public land with an average seasonal licensed trailing use of 441 AUMs. The trail is used to move

sheep to and from winter and spring ranges near Rangely and in Utah.

Livestock operations in the area have evolved around the use of public lands (BLM) and intermingled private and state lands as the basis of a range livestock operation. Hay is produced on private, irrigated lands to provide feed during winter periods when livestock are not on public land. Winter feeding is normally carried out from January through mid April.

The *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980), the Rangeland Program Summary (USDI, BLM April 1981) and the Rangeland Program Summary, First Update (USDI, BLM December 1981a) focused on forage allocation and grazing management. The documents discussed five major actions: 1) initiation of intensive grazing management, 2) continuation of existing grazing management practices, 3) allocation of forage among the predominant grazing animals and other uses, 4) prescription of a minimum period of rest from livestock grazing for each allotment, and 5) development and construction of range improvements to enhance rangeland productivity and management.

Subsequent to the release of those documents, the level of rangeland management in the planning area has been intensified as a result of the implementation of two new Allotment Management Plans and the development of range improvements on the five allotments presently being intensively managed. However, the proposed Rangeland Management Program as identified in the aforementioned documents will not be implemented at the previously anticipated level due to budgetary restrictions.

Decisions adjusting livestock grazing use in the planning area were completed in the spring of 1982. The level of existing grazing use indicated in Table III-3 represents the initial stocking level of three increments to be implemented over a five year period as a result of the decisions. Further adjustments will be tied to the results of rangeland monitoring studies presently in progress (consult Table III-3).

The amount of grazing use varies among operations. Some permittees use all their authorized animal unit months while others, due to economic conditions, are not fully utilizing their preference. Present average active livestock use in the planning area is 55,324 AUMs annually (based on a five year average excluding trailing use), which is 1,692 AUMs below the maximum authorized use of 57,016 AUMs.

For more detailed information on livestock grazing in the planning area consult the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980), the Rangeland Program Summary (USDI, BLM April 1981), the Rangeland Program Summary, First Update (USDI, BLM December 1981a), the Rangeland Program Summary, Second Update (USDI, BLM January 1984), and the Piceance Basin Planning Unit Resource Analysis, Step III (USDI, BLM 1980).

TABLE III-3

ALLOTMENT ACTIONS PROPOSED

Allotment		Percent Federal Range [1]	Kind of Livestock	Present Authorized Livestock Use AUMs [2]	Actual Livestock Use (AUMs)[3]	Scheduled Adjustments in Present Authorized Use (AUMs)			Monitoring Program [5]
No.	Name					1982	1984	1986[4]	
6001	Puckett Gulch	3	Cattle	21	21	21	21	21	A/U/T/C
6002	Pine Knot Gulch	60	Cattle	96	98	96	96	96	A/U/T/C
6003	Wood Road Gulch	50	Cattle	72	72	72	72	72	A/U/T/C
6004	Powerline	50	Cattle	71	71	71	71	71	A/U/T/C
6005	North Dry Fork	100	Cattle	1,005	1,005	877	877	845	A/U/T/C
6006	Little Hills	100	Cattle	5,691	5,076	5,263	4,834	4,405	A/U/T/C
6007	Main Dry Fork	100	Cattle	1,536	1,536	1,464	1,464	1,392	A/U/T/C
6008	Segar Gulch	85	Cattle	3,499	2,543	3,183	2,867	2,550	A/U/T/C
6009	Hyberger	100	Cattle	390	391	350	310	265	A/U/T/C
6010	Little Rancho	100	Cattle	260	260	260	260	260	A/U/T/C
6011	Thirteen Mile	100	Cattle	1,020	896	765	765	765	A/U/T/C
6012	Fourteen Mile	23	Both	850	773	694	538	380	A/U/T/C
6014	Lower Fourteen Mile	75	Sheep	150	150	150	150	150	A/U/T/C
6015	Gordon Gulch	44	Sheep	450	450	450	450	450	A/U/T/C
6016	Davis Creek	31	Sheep	546	378	546	546	546	A/U/T/C
6017	Coyote-Schutte	62	Sheep	578	561	578	578	578	A/U/T/C
6019	Cow Creek	45	Both	2,083	1,647	1,934	1,785	1,635	A/U/T/C

TABLE III-3—Continued

ALLOTMENT ACTIONS PROPOSED

Allotment No.	Allotment Name	Percent Federal Range [1]	Kind of Livestock	Present Authorized Livestock Use AUMs [2]	Actual Livestock Use (AUMs)[3]	Scheduled Adjustments in Present Authorized Use (AUMs) 1982	1984	1986[4]	Monitoring Program [5]
6022	Davis Canyon	60	Cattle	195	195	175	155	135	A/U/T/C
6023	Piceance Mountain	62	Cattle	14,716	14,586	13,840	13,840	13,243	A/U/T/C
6024	Fawn Creek	71	Cattle	2,465	2,461	2,035	2,035	2,035	A/U/T/C
6025	Skinner Ridge	30	Cattle	286	284	286	286	286	A/U/T/C
6026	Reagles	100	Cattle	1,266	1,616	1,616	1,616	1,616	A/U/T/C
6027	Square S	74	Cattle	4,390	4,070	4,390	4,390	4,390	A/U/T/C
6028	Hatch Gulch	100	Cattle	760	762	760	760	760	A/U/T/C
6029	Black Sulphur	71	Cattle	1,921	1,916	1,921	1,921	1,921	A/U/T/C
6030	Yellow Creek	81	Cattle	3,618	3,118	3,618	3,618	3,618	A/U/T/C
6031	Duck Creek	90	Cattle	1,490	1,488	1,490	1,490	1,490	A/U/T/C
6032	Spring Creek	95	Cattle	4,567	4,570	4,567	4,567	4,567	A/U/T/C
6033	E. Fork Spring Creek	52	Cattle	321	322	321	321	321	A/U/T/C
6036	Greasewood	92	Cattle	1,687	1,685	1,687	1,687	1,687	A/U/T/C
6038	Little Spring Creek	90	Cattle	1,183	385	1,057	931	805	A/U/T/C
6039	Hammond Draw	100	Cattle	215	215	215	215	215	A/U/T/C
6040	Upper Fletcher	100	Cattle	680	513	629	577	525	A/U/T/C
6041	Lower Fletcher	100	Cattle	612	311	612	612	612	A/U/T/C
6042	Boise Draw	100	Sheep	1,023	899	1,023	1,023	1,023	A/U/T/C
	Total	.....	.....	59,713	55,324	57,016	54,728	53,730	

[1] Percent livestock forage produced on public rangelands within an allotment versus production on private and state rangelands.
[2] Present Authorized Livestock Use = Active Qualifications December 1981.
[3] Actual Livestock Use = Average of active qualifications licensed for active use each year for past eight years December 1981.
[4] This is the initial livestock allocation which has been determined to be the proper livestock stocking level.
[5] U = Utilization; A = Actual use; T = Trend; C = Climate. The number of studies and frequency of data gathering will be determined by allotment management plans developed and budget constraints.
Source: Rangeland Program Summary, First Update (USDI, BLM December 1981).

Resource Condition and Trend

Since the beginning of the implementation of the *Proposed Grazing Management Program for the White River Resource Area, Environmental Impact Statement* (USDI, BLM April 1980) in May 1980, there has been a noticeable improvement in range condition and apparent trend in the Piceance Basin.

While the effect of above normal growing season precipitation on forage production cannot be disregarded, measurable improvement in range condition can be directly attributed to range improvement practices in specific areas. These range improvements include fences, water developments, vegetation manipulations and improved livestock management practices. The overall effect of these developments has been to improve livestock distribution in the basin and foster more uniform forage utilization, thereby enhancing rangeland productivity.

Following the beginning of implementation in May 1980, 28 miles of new fences have been constructed, 5 new wells have been equipped, 18 stock reservoirs and 4 miles of pipeline have been built. In addition, 8 springs have been reconstructed. Approximately 2,900 acres of sagebrush have been sprayed.

In 1983 in the Piceance Basin, one new well was drilled, two wells were equipped, 8.5 miles of pipeline were constructed, and 6 springs were developed or reconstructed.

The primary thrust of the fencing program has been to provide for deferment of higher elevation summer range use to improve cover and production of key forage species. That such fencing is an effective range improvement practice is proven by the fact that one operator increased the average weaning weight of his steer calves by 50 pounds in the first year after division fence construction. This increase can be directly attributed to increased grass vigor and production as a result of deferment.

Virtually all range improvement work done in the last three years has taken place on allotments under Allotment Management Plans. The effect of these improvements is already noticeable.

Demand and Dependency

Total livestock forage production in the planning area from state, private and public lands contributes 10 percent of the total regional (Rio Blanco, Routt and Moffat Counties) and 0.5 percent of the total state livestock feed requirements (Margolis 1976). Total livestock forage produced on the public land in the planning area contributes 3.0 and 0.2 percent of the livestock forage needs for the region and state, respectively. Public land in the planning area provides 30 percent of the total planning area livestock forage requirements.

Table III-4 shows that 70 percent of the permittees in the Piceance Basin Planning Area depend on BLM administered lands for over 20 percent of their livestock forage and 50 percent of the permittees depend on these lands for over 30 percent of their forage. As a result of this, and the fact that much of the forage from public lands is required in the spring, the permittees depend substantially on BLM permits.

TABLE III-4

PERCENT OF GRAZING OBTAINED FROM BLM LANDS BY OPERATORS HOLDING BLM PERMITS [1]

Percent of Forage Obtained from BLM Lands	Percent of Operators	No. of Operators
0-10	17	5
11-20	13	4
21-30	20	6
31-40	30	9
41-50	13	4
51-60	0	0
61-70	7	2
71-80	0	0
81-90	0	0
91-100	0	0
Total	100	30

[1] Source: Data on file at the White River Resource Area Office, Meeker, Colorado.

Fifty-seven percent of the permittees have a high dependency and 30 percent have a medium dependency on BLM grazing permits for forage on public lands (Table III-5). Spring forage is a key factor in determining dependency because ranchers must remove cattle from private meadows as early as possible to maximize hay production.

Eighty-three percent of the livestock produced in the planning area are produced on ranches that are highly dependent on public lands. Fourteen percent are produced on ranches that show a medium dependency.

Since the gathering of data in 1978 for the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980), the percentage of forage provided by BLM administered lands in the planning area has risen slightly from 29.6 percent to 30.0 percent. Because almost all the ranches in this area have BLM permits, one can safely assume that BLM permittees' dependence on public land has also risen slightly. The major reason for this is because the livestock market has been in a slump the last few years. Production costs have been rising, with the exception of livestock grazing fees on public lands. The grazing fees have decreased from a high of $2.36 to a low of $1.37 during this time period.

TABLE III-5

DEPENDENCE ON BLM GRAZING PERMITS [1]

Dependence	No. of Operators	Percent of Total
High	17	57
Medium	9	30
Low	4	13
Total	30	100

NOTE: High means that BLM forage is judged to be an essential element for the survival of the ranching operation. Medium means that BLM forage use may or may not be an essential survival element. Low means that BLM forage use is judged not to be essential to the ranching operation's survival.

A judgemental estimate of the criticality of rancher dependency on public land grazing was made by BLM personnel by applying the following three criteria to each ranching operation:

1. Proportion of forage acquired on public land
2. Season that forage is acquired
3. Ease of acquiring alternate sources of forage

[1] Source: Data on file at the White River Resource Area Office, Meeker, Colorado.

There is a high demand for BLM grazing permits or leases. The present $1.37 per AUM fee that the BLM charges compares to a fair market value for western rangelands of $8.36 per AUM (USDA, Economics, Statistics and Cooperative Service 1980). This does not mean that some permittees do not have more invested in their BLM permits than the $1.37 per AUM, especially if one considers mortgage costs (due to the value that BLM permits add to private land and the collateral they provide for bank loans) and range improvement development and maintenance costs not assumed by the BLM. However, it does mean that BLM would probably have little trouble in finding people to lease its grazing privileges at this current rate.

Ranching in the planning area is also socially and culturally significant. The Piceance Basin Planning Area is sparsely populated and agriculturally oriented. Even though towns such as Meeker and Rifle have grown recently due to energy development, there remains a large segment of the population with an agricultural orientation. Many townspeople

come from ranches or have been around ranching all their lives. For the people in the Piceance Basin Planning Area, ranching is not just a business but a way of life.

WILD HORSES

In May 1981, the Herd Management Area Plan for wild horses in the White River Resource Area was completed and approved. This plan designates the area on which horses will be managed and states how the maintenance of a viable herd will be achieved.

Sixty-four percent (105,424 acres) of the Herd Management Area lies within the planning area (Figure III-8). This area presently has an estimated population of 110 horses and includes all of the Yellow Creek allotment and Pasture C of the Square S allotment. The remaining 49 horses occur outside the Herd Management Area in six other allotments to the north and northwest.

There are essentially three distinct management units in that part of the Herd Management Area which lies within the Piceance Basin. These are Pasture C of the Square S allotment, Boxelder pasture of the Yellow Creek allotment and the Barcus-Pinto and Rocky Ridge pastures of the Yellow Creek allotment. All three areas provide a good mixture of seasonal ranges for horse habitat.

In 1979 and again in 1981, a total of 220 horses were gathered from the Pasture C and Boxelder use areas. Both areas had excessive populations in relation to the range carrying capacity and a deterioration in range condition was occurring. These areas presently have populations of 32 and 34 horses, respectively. The removal of excess horses from these areas has resulted in a marked improvement in range condition and production in both pastures. Maintenance of the population in both areas at this level should continue to foster further improvement in range condition.

In September 1983, approximately 50 horses were gathered in the Barcus-Pinto-Rocky Ridge area. Approximately 45 horses remain in the area, with small-scale removals to be made in later years.

Since the completion of the Herd Management Area Plan, one new water well in the Barcus-Pinto area has been drilled and equipped. One well, one water catchment and 680 acres of serviceberry-sagebrush burning are scheduled for 1984-1986 in Pasture C, Square S. For more detailed information consult the Herd Management Area Plan (USDI, BLM May 1981), the Cathedral Bluffs-Lower Piceance Basin Wild Horse Removal Plan (USDI, BLM January 1983) and the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980).

WILDLIFE HABITAT

Current wildlife management in the planning area consists partially as a support function to range management and the development of oil shale, oil and gas. Recommendations are made to manage for energy development with minimal impact to the wildlife resource. The Piceance Basin Habitat Management Plan is currently being implemented to improve habitat conditions. Habitat Management Plan actions are directed to selected species of recreational importance, raptors and threatened or endangered species.

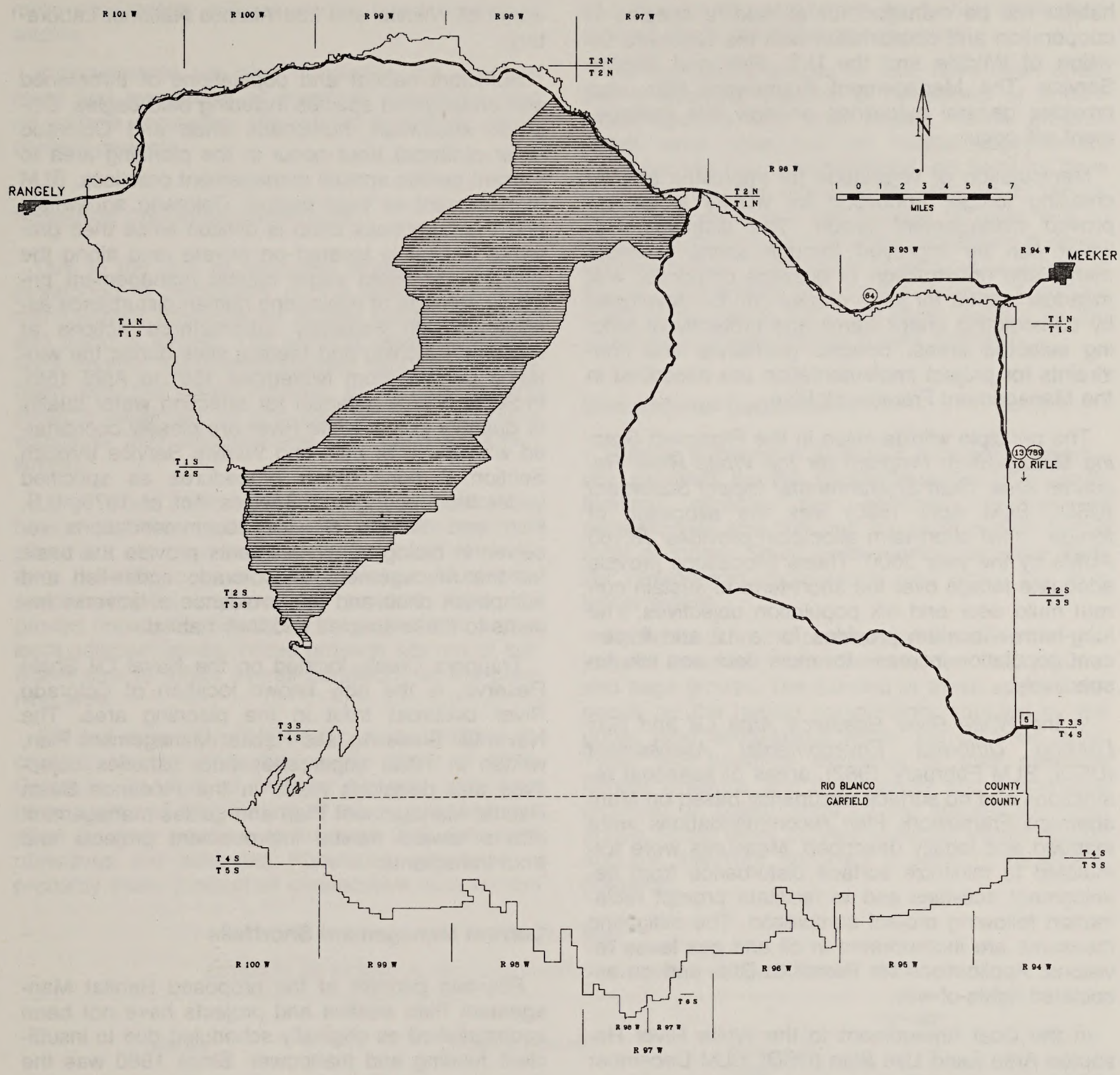
Current Management

The Piceance Basin Habitat Management Plan, written in 1976 and updated in 1980, is the activity plan which provides a basis for coordinated achievement of wildlife and habitat management goals and objectives consistent with other resource uses. Three major objectives were identified and analyzed in detail: establishment of specific management goals, delineation of habitat improvement projects and identification of important inventories and monitoring studies.

Specific management goals included the establishment of population objectives for mule deer (40,000) and elk (1,200) winter ranges. Desired vigor ratings, cover densities and utilization levels for browse on each mule deer key winter range area are identified. Fifty-six habitat improvement projects were proposed to improve existing habitat conditions for mule deer, elk, sage grouse and fish. Two projects were also identified to develop new aquatic and riparian habitat for waterfowl and shorebirds. These projects are scheduled objectives for both wildlife and livestock.

Field studies were conducted from 1976 to 1978 to gather information necessary to base land management decisions. Data collected consists of delineation of sage grouse special use areas, measurement of forage competition between mule deer and livestock on winter range, assessment of vegetation manipulations on non-game wildlife populations, and mapping and characterization of riparian and aquatic habitats.

The White River Resource Area Management Framework Plan (USDI, BLM 1981) dictates that



Wild Horse Herd Management Area

WILD HORSE HERD MANAGEMENT WITHIN THE PLANNING AREA

Figure III-8

habitat will be managed for all wildlife species in cooperation and coordination with the Colorado Division of Wildlife and the U.S. Fish and Wildlife Service. The Management Framework Plan also provides general guidelines on how this management will occur.

Manipulation of vegetation for improving and increasing forage production for wildlife is an approved management action. The distribution of water can be improved through spring developments and construction of guzzlers or ponds. Wet meadow habitat for sage grouse can be developed by constructing check dams and protectively fencing selected areas. Specific guidelines and constraints for project implementation are described in the Management Framework Plan.

The principle wildlife issue in the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980) was the allocation of forage. Initial short-term allocation provides 36,160 AUMs by the year 2000. These allocations provide adequate forage over the short-term to sustain current mule deer and elk population objectives. The long-term allocation provides for a 12 and 8 percent population increase for mule deer and elk, respectively.

In the *White River Resource Area Oil and Gas Leasing Umbrella Environmental Assessment* (USDI, BLM February 1982), areas of seasonal restrictions and no surface occupancy based on Management Framework Plan recommendations were mapped and legally described. Measures were formulated to minimize surface disturbance from development activities and to facilitate prompt reclamation following project completion. The mitigating measures are incorporated in oil and gas lease revisions, Applications for Permit to Drill, and on associated rights-of-way.

In the Coal Amendment to the White River Resource Area Land Use Plan (USDI, BLM December 1981b), about 4,960 acres were designated as unsuitable for further consideration for surface methods, but suitable with stipulations for subsurface methods of coal development. These areas were restricted based on the requirements of Criterion 11: Bald and Golden Eagle Nests and Criterion 15: State Resident Fish and Wildlife.

BLM is cooperating with the Cathedral Bluffs Shale Oil Company, Rio Blanco Oil Shale Company and Water Users Association Number One to develop and implement habitat management and mitigation plans to avoid or minimize damage to fish and wildlife from these large-scale development projects. BLM is also involved with ongoing field studies and research projects with the Colorado Division of Wildlife and Los Alamos National Laboratory.

Sufficient habitat and populations of threatened and endangered species including bald eagles, Colorado squawfish, humpback chub and Colorado River cutthroat trout occur in the planning area to warrant certain special management practices. BLM management of bald eagles, Colorado squawfish, and the humpback chub is difficult since their preferred habitat is located on private land along the White River. Bald eagle habitat management primarily consists of minimizing human disturbance associated with Federally administered actions at roosting, perching and feeding sites during the wintering periods from November 15th to April 15th. Projects with a potential for affecting water quality or quantity in the White River are closely coordinated with the U.S. Fish and Wildlife Service through Section 7 consultation procedures as specified under the Endangered Species Act of 1973. U.S. Fish and Wildlife Service recommendations received in biological assessments provide the basis for the management of Colorado squawfish and humpback chub and the avoidance of adverse impacts to these species and their habitat.

Trappers Creek, located on the Naval Oil Shale Reserve, is the only known location of Colorado River cutthroat trout in the planning area. The Naval Oil Shale Aquatic Habitat Management Plan, written in 1982, supercedes prior fisheries objectives and decisions made in the Piceance Basin Habitat Management Plan and guides management efforts toward habitat improvement projects and trout transplants.

Current Management Shortfalls

Fifty-two percent of the proposed Habitat Management Plan studies and projects have not been accomplished as originally scheduled due to insufficient funding and manpower. Since 1980 was the last year for Habitat Management Plan implementation, Habitat Management Plan projects were rescheduled for 1981 to 1988 (pending adequate funding) in conjunction with implementation of the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980).

Project and habitat monitoring has not been performed since 1977 also due to manpower deficiencies. Therefore, wildlife objectives within the planning area are not being met. Reseeding of disturbed areas to benefit wildlife has not been adequately implemented. Methodology needs to be developed, especially in oil and gas development areas and on associated rights-of-way projects, to

more successfully replace wildlife forage losses to wildlife.

Improvements are also needed in the enforcement and monitoring of seasonal restrictions and no surface occupancy stipulations on energy development projects.

Resource Condition and Trend

Due to the lack of adequate project and habitat monitoring, a discussion of the effect of existing management practices on wildlife habitat condition and trend is limited. The existing seasonal restrictions and no surface occupancy stipulations have been effective when applied to mineral leasing projects especially oil and gas. However, in other situations their effectiveness has been extremely limited.

Large scale implementation of forage allocation, habitat condition goals and allotment management plans has not been in effect long enough for long-term benefits to have been achieved. Most site-specific habitat improvement projects have improved habitat conditions on the project site and in local adjacent areas. These projects are not of sufficient size to affect overall conditions of the planning area.

Elk and especially mule deer populations have increased steadily since the severe winter of 1978. Colorado Division of Wildlife harvest objectives have promoted stabilization of elk populations, but allow for deer numbers to increase until deer herd objectives are achieved. Population expansion is probably more a result of consecutive mild winters and seasons of good forage production rather than a direct result of habitat management.

Management practices to date have been effective in avoiding impacts to threatened or endangered species and their habitat. Since projects which were scheduled for habitat improvement have not yet been implemented, no benefits have been derived. The potential for impacts to threatened or endangered fish species is great due to water requirements for oil shale processing if development occurs. The quality of bald eagle habitat is rapidly deteriorating due to the decline of cottonwood stands along the White River. Habitat for the Colorado cutthroat trout is in poor condition.

Demand and Dependency

Hunting is the most important recreation opportunity provided by the wildlife resource. Big game hunting attracts the greatest number of recreationists and provides the most money to the local economy. Small game hunting, trapping, wildlife viewing and photography also occur, but to a lesser extent.

Public lands in the planning area provide the majority of essential habitat for mule deer, elk, raptors, and sage grouse. The survival of these species depends on the habitat components afforded by the public land ecosystems within the planning area. Table III-6 presents estimates of total essential habitat available and the quantity and percentage provided on public lands for the species identified above. Public lands provide essential wildlife habitat and are, therefore, important to users of the wildlife resource.

TABLE III-6

ESTIMATE OF ESSENTIAL WILDLIFE HABITAT AVAILABLE IN THE PLANNING AREA

Species	Habitat Feature	Acreage			
		Public Land	State	Private	Total
Mule Deer	Severe Winter Range	118,670	11,702	13,750	144,122
	Winter Concentration Area	3,745	3,097	6,065	12,907
	Winter Range	333,980	6,257	53,660	393,897
Elk	Summer Range-Critical Habitat	61,130	3,505	24,010	88,645
	Winter Range	223,917	--	42,975	266,892
	Resident Population	32,337	302	10,115	42,754
Mountain Lion	Winter Range	384,985	18,492	56,015	459,492
	Concentration Area	24,297	2,967	3,490	30,754
Sage Grouse	Brood Habitat	56,237	4,025	32,792	93,054
	Winter Range	38,292	1,705	13,665	53,662
	Nesting Habitat	26,360	--	15,512	41,872
Raptors	Buffer Zones and No Surface Occupancy.	12,380	32	127	12,539
Bald Eagles	Wintering Areas	1,935	155	8,422	10,512
	Concentration Areas	1,452	160	4,367	5,979

TABLE III-6—Continued

ESTIMATE OF ESSENTIAL WILDLIFE HABITAT AVAILABLE IN THE PLANNING AREA

Species	Habitat Feature	Acreage			
		Public Land	State	Private	Total
Colorado River Squawfish, Humpback Chub	Overall Distribution	5	2	127	134
Colorado River Cutthroat Trout	Overall Distribution	1.9 mi	--	3.4 mi	5.3 mi

THREATENED, ENDANGERED, RARE AND SENSITIVE PLANTS AND REMNANT VEGETATION ASSOCIATIONS

Protection of threatened and endangered plants is required and directed by the Endangered Species Act of 1973; whereas, protection of rare and sensitive plants is discretionary with guidance provided by BLM policy. Current management actions are designed to protect, conserve and manage existing and proposed Federal and state listed threatened, endangered or sensitive plant species. Presently, no officially listed threatened or endangered plants occur in the planning area. Actions authorized by BLM will provide for the conservation of rare and sensitive plant species and the enhancement and maintenance of their habitat.

There are presently no areas within the planning area that are managed specifically for protection of sensitive plant species or remnant vegetation associations. Sensitive plant species are currently managed by identifying locations and habitats to ensure protection of these areas whenever possible. On-the-ground surveys for sensitive plant species are required by a qualified specialist prior to any surface disturbing activity in areas of potential habitat on public land. If threatened, endangered, sensitive or rare plant species are located within the proposed project areas, mitigating measures will be taken to avoid adversely impacting the recorded plant species.

CULTURAL RESOURCES

Cultural resources are the fragile, nonrenewable remains of human activity, occupation or endeavor, reflected in districts, sites, structures, buildings, objects, artifacts; ruins, works of art, architecture, and natural features that were of importance in human events (BLM Manual 8100). Cultural resources, both prehistoric and historic, represent a part of the continuum of events from the earliest evidences of man to the present. Cultural resource sites vary in size and range from the location of a single object (isolated find) to a cluster of cultural resource structures with associated objects and features.

Cultural resources on public land are protected by a battery of Federal legislation which dates from the Antiquities Act of 1906 up through the 1980 Amendments to the National Historic Preservation Act of 1966. The purpose of these laws is to protect significant cultural resources from damage or destruction and to ensure adequate mitigation to preserve the data which these sites possess.

Current Management

The majority of inventories done for cultural resources in the planning area were done by private archaeological consulting firms working for energy companies. These inventories were performed under Antiquities Permits issued by the U.S. Department of the Interior and the reports are reviewed and accepted by the White River Resource Area. Block surveys in the area were performed for proposed oil shale development.

One Class II sample field inventory was performed to field test the accuracy of a predictive model developed on contract for the BLM (Newkirk and Roper 1983).

The BLM has designated three classes of cultural resource inventory (BLM Manual 8100).

Class I - Review and synthesis of existing information; literature search.

Class II - Field sampling inventory (a 10 percent statistical survey is considered a sound sample); a tool for management or planning activities, NOT project clearance.

Class III - Intensive field inventory; 100 percent pedestrian survey.

Existing BLM Colorado state policy specifies the extent and instances when Class III inventory is re-

quired. Inventory requirements differ according to type of project proposed. Due to the sensitive nature of cultural resources in the Piceance Basin, resource area policy requires a Class III inventory prior to any surface disturbing activity proposed on public land. On Bureau initiated projects, such as range improvements or firewood sales, a Bureau archaeologist conducts the inventory. On projects proposed by industry or other government agencies, the Bureau archaeologist is responsible for reviewing the technical adequacy of the report prepared by an approved archaeologist hired by the applicant.

When sites are located they must be evaluated for their significance and potential eligibility for nomination to the National Register of Historic Places. Avoidance is the preferred and most economical method of reducing adverse impacts to the cultural resource and project relocation is the most frequently used mitigating measure. If project relocation is not deemed feasible, and the site meets the National Register eligibility criteria, Section 106 consultation with the State Historic Preservation Office is required (36 CFR 800).

The Craig District does not have the manpower or provisions for the surveillance of cultural sites in the planning area. Vandalism does occur but seems to result from increased access to the area which enables recreator to reach cultural sites. No known black market activity for the sale of antiquities exists in the planning area.

The identification and protection of sites in the planning area occurs in direct relation to energy development. Current manpower restrictions do not allow for additional survey for purely scientific purposes. A cultural resource management plan has not been written for the planning area due to a low priority for cultural resource activity in the Piceance Basin.

Resource Condition and Trend

The abovementioned cultural resource management practices are considered to be the bare minimum necessary to ensure the protection of cultural resources in the planning area. While the management program used in the planning area is one of the most streamlined and consistent in the state, it is responsive to development needs but does not allow for study leading to the formulation of important research questions.

Demand and Dependency

The cultural resource management program in the planning area is a support function of other Bureau programs such as lands and minerals, range and forestry. The Bureau is not able to meet the demand for archaeological inventories for industry and this has created the need for private cultural resource consultants in the private sector. The economic effect of industry's cultural resource inventory needs on these consultants has been significant regionally. The current slump in energy development has adversely affected many of these private consultants and some have gone out of business.

PALEONTOLOGICAL RESOURCES

Under the mandate of the Antiquities Act of 1906, Section 30 of the Mineral Lands Leasing Act of 1920, the National Environmental Policy Act of 1969 and the Federal Land Policy and Management Act of 1976, the Bureau of Land Management would be required to identify, evaluate and protect paleontological resources within public lands.

A classification system based on the likelihood of occurrence of significant or potentially significant paleontological resources within respective geologic formations has been developed by the Bureau of Land Management. This classification system and the geologic formations the classes occur in (within the planning area), are described in Table III-7. Figure III-9 illustrates the paleontological classifications present within the planning area.

TABLE III-7

PALEONTOLOGICAL CLASSIFICATION SCHEME FOR PUBLIC LANDS AND THE GEOLOGICAL FORMATIONS IN WHICH THE CLASSES OCCUR WITHIN THE PICEANCE BASIN PLANNING AREA

Class I-a:	Areas where immediate detailed study is needed. Fossils of scientific interest are exposed on the surface, or are very likely to be discovered by detailed field work in the area. This classification is to be used for site-specific localities having scientifically significant fossils. No lands with this classification have been identified in the Piceance Basin Planning Area.
Class I-b:	Areas with a high potential for producing scientifically significant fossils. In these areas, a paleontological evaluation will be done by the geologist or paleontologist, on a case-by-case basis, prior to any surface-disturbing activities. These evaluations will change the classification for these areas to Class I-a, II or III, as appropriate. The majority of the lands in the planning area are classified as I-b. The I-b classification is found in the Uinta, Green River and Wasatch Formations.



Class Ib. Fossils of Scientific Value
Class II. Evidence of Fossils
Class III. Fossil Occurrence Unlikely

PALEONTOLOGICAL RESOURCE CLASSIFICATIONS OF THE PICEANCE BASIN

Figure III-9

TABLE III-7—Continued

PALEONTOLOGICAL CLASSIFICATION SCHEME FOR PUBLIC LANDS AND THE GEOLOGICAL FORMATIONS IN WHICH THE CLASSES OCCUR WITHIN THE PICEANCE BASIN PLANNING AREA

Class II:	Areas with evidence of fossils but in which the presence of fossils of scientific significance has not been established and is not anticipated. Detailed study may be desireable in the future for the evaluation of all types of fossil collecting. This classification may be used to identify recreational values of fossils. Small areas with this classification exist around the periphery of the planning area and occurs in the Williams Fork, Iles and Mancos Formations.
Class III:	Areas where there is little likelihood of finding fossils of scientific significance. No further consideration of fossils is necessary unless future discoveries require a change of classification. Alluvial lands in the planning area are Class III and located in the Quarternary Alluvium.

RECREATION

Public lands are classified into one of two categories for recreation management purposes: special or extensive.

Special recreation management areas (SRMAs), require intensive management to achieve recreation objectives and require BLM to take action in order to provide specific recreation opportunities. BLM recreation investments are concentrated in these areas.

Extensive recreation management areas (ERMAs) are areas where significant recreation opportunities and problems are limited and where intensive recreation management is generally not required. Limited management actions (access, visitor information, signs, etc.) are usually adequate.

The entire Piceance Basin Planning Area is currently managed as an ERMA, although heavy use during hunting season could justify identification of a SRMA in the Cow Creek, Divide Road, Cathedral Bluffs, Calamity Ridge and Yellow Creek areas. Very limited recreation management now occurs, and is only as a result of overlap with other programs. This includes the provision of access to significant and/or large blocks of public land, visitor information at the White River Resource Area office, signing of access routes and other key features, and trash pick-up at designated sites during hunting season.

The resource area maintains a hunter information station at the area office. It is usually manned by one or two employees who are knowledgeable of big game, access, land status and hunting regulations. Up to 1,500 visitors have utilized this service in a peak season. An effort has been made to have one or two BLM employees in the field to provide information and use supervision, however this function only occurs as time and funding permit.

No effort is made to provide restrooms, dump stations, improved campsites or potable water for the estimated 20,000 camp days spent in the basin during hunting season. Over 110 concentrated primitive camp areas were identified in 1981 during a cursory field exam. Many additional scattered sites are also heavily used. Most of these areas are in a poor condition, with scattered litter, broken fire rings and beaten down vegetation. Human waste around the sites poses a potential health hazard.

Temporary fire crews are utilized for litter pickup, but generally the litter goes unattended until the following summer. In another effort to control litter, BLM issues a contract for trash pickup at several sites throughout the basin. This service runs for about a month during hunting season.

The White River Management Framework Plan includes decisions to develop a recreation management plan for the Cathedral Bluffs scenic overlook, develop recreation oriented public information materials, post all major access routes to public lands and complete an ORV plan as required in BLM regulations. Due to a lack of funding and change in BLM recreation policy, the only recommendation implemented has been posting of some of the access roads.

The White River runs along the northern boundary of the planning area. It is little used for recreation at this time, but has potential for providing water based recreation opportunities that are currently limited in the planning area.

Resource Condition and Trend

As outlined in Chapter II, the primary and almost singular recreation use of this planning area is big game hunting mainly during the fall months, with the largest concentrations occurring in October/November.

On opening day of deer/rifle season, as many as 6,400 hunters have been estimated in the Piceance Basin. With the area being 1,038 square miles in size, this makes the hunter density 5.7 hunters per square mile. This concentration may be accepted for rural and semi-primitive motorized classes, however, based on past planning, safety and quality of experience may be jeopardized. Hunters seeking more solitude generally do not hunt in the Piceance Basin. The success of the hunt is very dependent on the cyclic variations in deer populations.

Some dozen major access roads exist providing both physical and legal access to a majority of the public lands in the basin. Access elsewhere in the basin is limited due to rugged topography and surrounding private property restricting public passage. Because of this, hunting and camping use is concentrated along such areas as Cow Creek, Divide Road, Cathedral Bluffs, Calamity Ridge and Yellow Creek Jeep Trail; all are areas with good physical and legal access. Littering, vegetation damage or loss, soil compaction/erosion and vandalism are continuing problems associated with the large number and concentrations of hunters. Also, due to inadequate signing and maps, many hunters new to the area get lost, stuck, delayed or even arrested for trespassing on private lands. Each year BLM receives numerous requests for updated recreation maps. Efforts to obtain public rights-of-way on key parcels is being attempted by the Colorado Division of Wildlife, but is a low priority.

Access to public lands along the White River is totally undeveloped. Opportunities for fishing, swimming, picnicking, hunting and tubing in a rural or roaded natural setting do exist, but use is low due to the lack of knowledge that these lands are public. No signs of any kind post public land boundaries along the river.

The general trend in recreation opportunity seems to be in a shift from semi-primitive motorized to a more roaded natural setting. This is due to increased roads that access oil and gas, and oil shale resources.

Demand and Dependency

Hunting opportunities in the Piceance Basin are highly sought after. Past national publicity has made the Piceance Basin one of the most popular deer hunting areas in the country, and as a result more than half of the big game hunters come from out of state. Competition for undeveloped campsites is fierce since there are few motels and no developed campgrounds within thirty miles of the area. Most hunters arrive several days before hunting season in order to scout out the area and claim a desirable location to set up camp. The demand for these opportunities is expected to remain high, but will fluctuate with cyclic variations in the big game herds and increasing pressure in other hunting areas around the country. An economic and social dependency has been built around hunting in local counties (see Chapter II, Economics section). With the decline in the energy related industries, local businesses, motels and hotels will increasingly depend upon hunting related business.

While hunting activities are the major recreation concern of BLM in the Piceance Basin, a statewide demand for water based recreation exists which has never been met by BLM in the White River Resource Area. Local pressure for fishing, swimming, picnicking, camping, boating and tubing has been mainly placed upon Trappers Lake, and Rio Blanco, Rifle Gap and Lake Avery reservoirs. A few public fishing access points exist on the upper White River (outside the planning area) and these are heavily used. Most river oriented use is directed at the Colorado River, about one hour away. Demand for water oriented activities is estimated to be moderate to high. Providing more river access, in any Recreation Opportunity Spectrum (ROS) class, would help satisfy this demand. Ten to 15 sites are available and would be suitable for access development.

Boating on the White River in particular could increase due to the recent Colorado Attorney General's opinion that floating through private property does not constitute a trespass. The intent of the state legislature was to protect private property owners from trespass to the banks and beds of streams while ensuring that the public's use of the waters of those streams for floating would not come within the criminal codes prohibitions. In addition, at least two recent books on floating Colorado rivers describe the White River within the planning area as providing a pleasant flat water experience. (*Rivers of the Southwest* by Anderson and Hopkinson, and *The Floaters Guide to Colorado* by Wheat.)

Demand in the basin for other types of recreation is presently low, and is expected to remain low.

Opportunities for all priority objectives of the Colorado State Comprehensive Outdoor Recreation Plan (nature study, camping, ORV activity and picnicking) exist in a variety of ROS classes within the Piceance Basin.

VISUAL RESOURCES

In addition to the scenic quality discussed in Chapter II, the 1978 visual resource inventory also identified two additional elements - visual sensitivity and viewing distance. Visual sensitivity is the degree of concern expressed by the user toward scenic quality and existing or proposed changes in the landscape. Viewing distance is determined by taking points along designated routes of travel and determining whether viewsheds are in the foreground, middleground, background or in areas that are seldom seen. All three elements - scenic quality, sensitivity and viewing distance - are combined to determine visual resource management (VRM) classes. These five classes establish the degree of

acceptable visual change within a characteristic landscape. Management objectives are established for each class. The definitions of each are included in the glossary.

The existing Management Framework Plan, using the 1978 inventory, established VRM classes for the Piceance Basin (see Figure III-10). Proposed activities are evaluated by the contrast rating system in order to quantitatively determine a project's visual impact. These ratings determine whether projects are acceptable or unacceptable in the management class they occur in. Those that are unacceptable are redesigned, mitigated, or cancelled. Unmitigatable projects which proceed may downgrade an area's Visual Resource Management class. Activities which cannot meet these objectives in the short-term are placed in an interim category (Class V). Long-term rehabilitation is expected to restore these areas to one of the other classes.

Resource Condition and Trend

Over the past ten years, the scenic quality of the Piceance Basin has undergone a gradual change from an area dominated by ranching and recreation to one increasingly dominated by energy development. These changes are related primarily to oil and gas exploration and development, and development on oil shale Tracts C-a and C-b. New roads, powerlines, pipelines and support structures are all associated with this development.

The primary travel route through the basin is the Piceance Creek Road (County Road No. 5). Much of the energy-related development is screened from this road by the topography of the Piceance Creek drainage and is therefore not visible to travelers on this route.

TRANSPORTATION

The need for new and improved transportation systems serving the Piceance Basin is directly linked to the demand for development of energy resources. As late as 1981, a boom was predicted in energy resource development. Plans and studies for transportation needs were culminated during this period. By the fall of 1981, demand for energy resources began to taper off due to a declining world market. At present, demand for energy resource development is at a very low point, and thus transportation needs are well covered by existing transportation systems. It is assumed that transportation plans previously completed are still valid but will not be implemented until such time as demand for energy resources dictates expanding production.

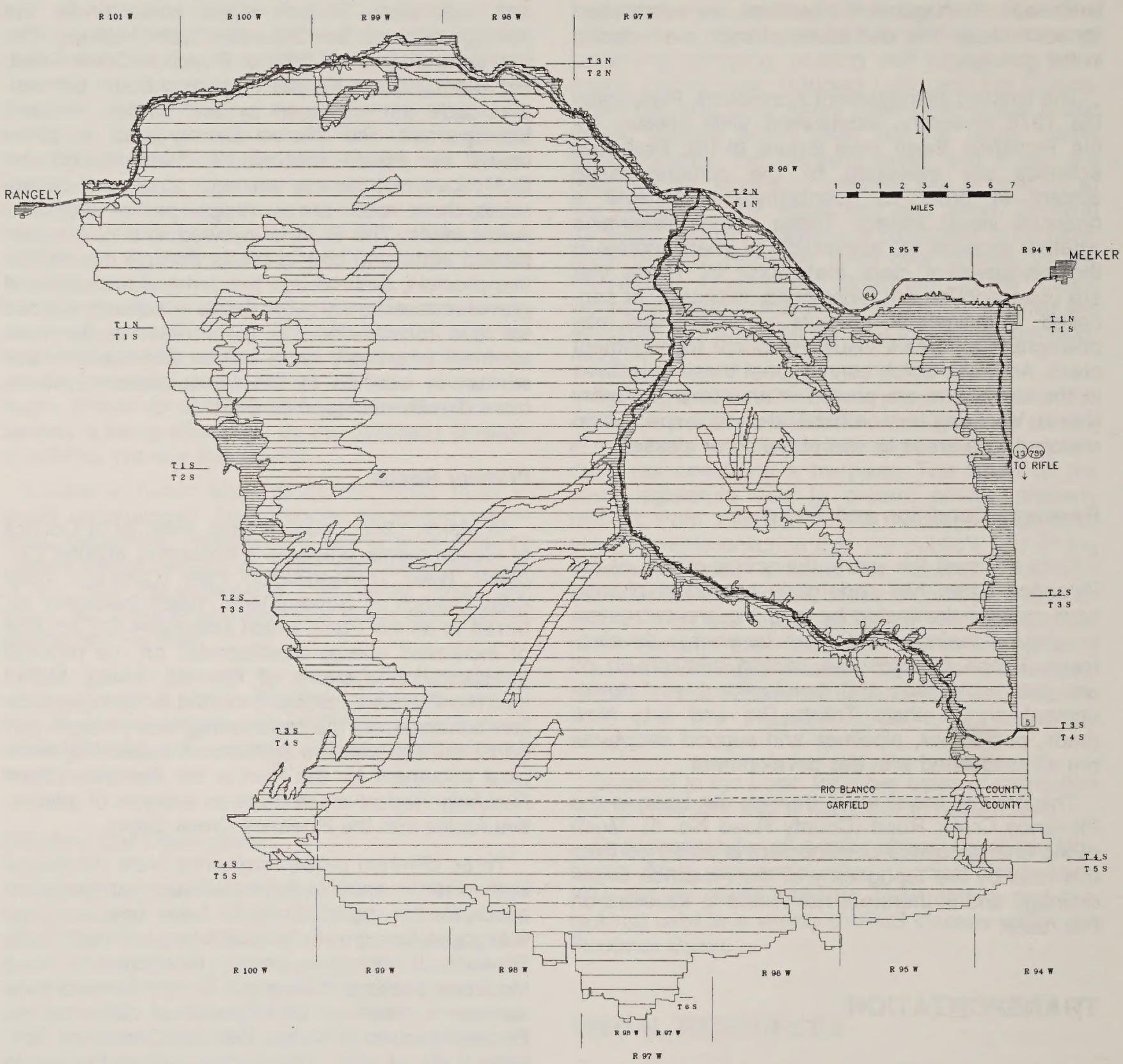
In Chapter II, roads were described as primary and secondary. Primary roads come under the management of the Colorado State Highway Department, and in the case of Piceance Creek Road, Rio Blanco County is the managing body. Secondary roads are managed by the Bureau of Land Management, Rio Blanco County and, in some cases, by private landowners. Even though the BLM does not directly manage state and county roads, these roads are an integral part of access to public lands. The BLM is involved with new or improved state and county roads through the permitting process, and through the demand for sand and gravel resources on public lands which are needed for road construction. For these reasons, the management of primary roads will be addressed in this section in addition to the transportation systems more directly managed by BLM.

Primary Roads

In March 1980, the Colorado West Area Council of Governments prepared a document entitled *Colorado West Transportation Plan* (Colorado West Area Council of Governments 1980) (hereafter referred to as the Plan), which addresses the impacts of increased energy development on the regional transportation systems of Garfield, Mesa, Moffat and Rio Blanco Counties. Included in its transportation concerns are the regional highway network, airports, rail and pipeline systems. A supporting technical document for the Plan is the *Piceance Creek Roadway Report* which gives an analysis of alternative routes into the Piceance Creek Basin.

Three different growth scenarios were developed in the Plan in order to forecast future transportation needs for the region. Scenario I was based on natural population growth without energy development, Scenario II forecasts energy development on a moderate scale; and Scenario III was formulated to address a maximum feasible rate of development. Recommendations of the Plan are based on Scenario II. As of 1983, growth has occurred closer to Scenario I, and thus many of the projected needs of 1985 are not valid for that date, but may become valid at sometime in the future.

The Plan indicates that the existing highway network provides a reasonable pattern of connections for regional needs, with the possible exception of additional needs for access into the Piceance Creek Basin. The *Piceance Creek Roadway Report* investigated various alternatives for access into the area. The top priorities for improved access were listed as a C-a Tract to Rangely route, and to a lesser extent, C-b Tract to DeBeque. These routes would serve commuters and energy site development traffic.



VISUAL RESOURCE MANAGEMENT CLASSES

Figure III-10

Additional recommendations of the Plan that have direct or indirect implications on the management of public lands are as follows:

- Haul truck volumes will be a significant problem on highway links and will pose major problems on adjacent communities. Therefore, rail and pipeline systems should be available on a schedule that coincides with large scale energy development. Construction of rail and pipeline systems is a private sector responsibility. The public sector would be involved through the permit process which provides rights-of-way across public lands. Common carrier pipelines and joint use of utility corridors should be encouraged as a means of minimizing environmental disruption. Because even interim (construction and initial production) periods of hauling by truck would seriously impact the highway system, it is recommended that no plant be permitted to produce more than 15,000 barrels of shale products a day without shipment by pipeline.

- Additional electrical transmission lines should be, to the extent possible, located in joint utility corridors.

- A roadway plan for access into the Piceance Creek Basin should be adopted when development demands justify the need.

- A significant portion of the commuting trips of the region's energy workers should be transported in high occupancy vehicles such as van pools, carpools and special buses.

- An extension of rail facilities into the Piceance Creek Basin which connects the rail terminus at Colowyo Coal Mine north of Meeker to energy sites in the basin would have a beneficial effect on highway needs.

- Through the permitting process, require simultaneous completion of energy projects and their related rail and pipeline links. This will minimize product-haul impact to communities and the regional highway system.

The Colorado State Highway Department was contacted concerning planned improvements to roadways in the Piceance Basin region. It was reported that no plans exist at this time. It was further related that the department has no plans to take Piceance Creek Road into the State Highway System (Leonard 1983). The Rio Blanco County Capital Improvements Program had targeted $4.2 million for the widening of Piceance Creek Road from 30 feet to 36 feet. Construction was to take place between 1982 and 1984. There are no current plans to implement this construction (Payne 1983).

Secondary Roads

BLM roads are inventoried and managed through the Craig District Transportation Plan. BLM roads are those roads necessary to allow access to the public lands for multiple use management. The District Transportation Plan, updated in 1979, outlines the road and trail needs identified through the Bureau's planning system. Another function of the District Transportation Plan is to coordinate transportation needs with the State and county. A Memorandum of Understanding has been arranged between the BLM, Craig District and Rio Blanco County for the construction and maintenance of a portion of the C-a Tract to Rangely road. The Calamity Ridge section of the road will remain a BLM road, but will be managed by the County with BLM input. The road has been partially constructed from the C-a Tract to Calamity Ridge Road. The final section (Phase III) has not been constructed and remains to be approved by the BLM.

The Management Framework Plan (USDI, BLM 1981) has identified access needs in the Piceance Basin for minerals development and BLM management. In some cases, these access routes cross private lands. During the summers of 1981 and 1982 an on-the-ground inventory was completed for roads in the Piceance Basin. The inventory lists BLM, county, private, oil and gas roads and trails, which are delineated on map overlays and on 7.5 minute USGS quads on file at the White River Resource Area office in Meeker.

The Oil and Gas Umbrella Environmental Assessment (EA) identifies access problems and mitigating measures. This document establishes policy and guidance on the location, design, maintenance and reclamation of oil and gas access roads. The EA recommends that a five year plan of development be submitted to BLM by the lessee prior to any drilling on the lease. The five year plan would require plans for placement and construction of main access roads into an area, and plans for product transportation out of an area. The purpose of this would be to develop a logical transportation plan for leases within an area that combines access and production lines into and out of the area so that parallel roads and pipelines could be eliminated. Such planning efforts could decrease access road mileage by approximately 27 percent, pipeline mileage by approximately 35 percent, and eliminate a corresponding amount of surface disturbance. The EA decision is to be implemented over time with voluntary acceptance by industry. To date only one company, Rio Blanco Natural Gas, has submitted a tentative five year plan for a lease within the Piceance Basin. Because of the voluntary nature of implementing five year plans, the success of using this management tool is limited.

Special stipulations for mitigating access impacts are developed in the permitting process and are made a part of Applications for Permit to Drill and rights-of-way. Stipulations are developed by onsite investigations, and are tailored to site-specific conditions. Technical aspects of road design, construction and reclamation are made available to operators. Oil and gas bonding is considered an assurance that reclamation is accomplished in a reasonable manner. However, the Oil and Gas Umbrella EA has pointed out that bonding is a weak method for insuring successful reclamation because bonding requirements are frequently too low.

Railroads

In July of 1981 the *Meeker-Piceance Basin Rail Feasibility Study* was completed by URS Engineers for the Colorado West Area Council of Governments. The study was initiated to determine the feasibility of new railroad lines into the Piceance Basin. A market survey found that eleven firms associated with mineral development in the Piceance Basin were interested in receiving rail service for proposed projects. Although all of the oil shale companies surveyed indicated pipelines to be the preferred mode of product shipment, it was calculated that pipeline systems could not come close to meeting projected capacity requirements for the region. It was estimated that a 50,000 bbls/day facility would require at least 15 cars per day. Of the six alternative routes investigated, one was selected as environmentally preferable and economically feasible. The selected route is 159 miles long and would extend north from Rifle past Meeker to connect with the Denver and Rio Grande branch line south of Craig. A spur from this connector tract would extend approximately 50 miles into the Piceance Basin. The route is depicted in Figure III-11 (URS Engineers 1981). The study reports that the preferred alternative is just barely economically feasible without direct government assistance.

Resource Condition and Trend

New construction of *temporary* roads and pipelines is directly proportional to the growth rate of oil and gas development. Oil and gas development in the planning area has taken place at an accelerated rate since 1975. The rate of development began to slow in the fall of 1981 due to declining world markets. The impact of accelerated development since 1975 has been a series of surface disturbances that individually are minor but cumulatively are significant. Some of the effects are loss of topsoil, erosion, siltation of waterways, loss of grazing resources, loss of wildlife habitat, loss of scenic values and increased air pollution due to dust. Current management practices attempt to mitigate these impacts, but some impacts are inevitable regardless of the practices followed. Implementation of the five year plans could be most successful in reducing impacts by reducing the amount of surface disturbance necessary to maintain production levels.

Demand and Dependency

Demand for transportation in the basin is directly related to the demand for the mineral resources located there. Effective transportation systems are an integral support function for development of these resources.

Mineral resource development has increased at a rapid pace over the past decade. Presently, a world oil glut has reduced demand for oil, gas, oil shale and coal. There has been a corresponding decline in demand for many other minerals. Historically, mineral development has followed a boom and bust cycle. It is expected that this cyclical phenomenon will continue and, at some point in the future, demand will again increase. Plans and management situations for transportation systems are still valid but will occur at a slower pace.

LANDS AND REALTY

The lands and realty program is charged with legally authorizing the use of public lands. The program is broken down into energy and non-energy uses which may be defined by use authorizations and land title transfers. Use authorizations involve rights-of-way, temporary use permits, land use permits and leases where private, corporate and governmental entities use public lands for project location. Land title transfers include exchanges, acquisitions, recreation and public purposes, sales or such actions involving eventual transfer of title between entities.

Use Authorizations

Rights-of-Way

In addition to the oil and gas pipelines identified in Chapter II, Transportation section, numerous rights-of-way have been issued for oil and gas access roads, electric powerlines and utilities associated with the oil and gas development. Detailed descriptions and the location of each one may be obtained from the White River Resource Area office. Rights-of-way are processed and approved

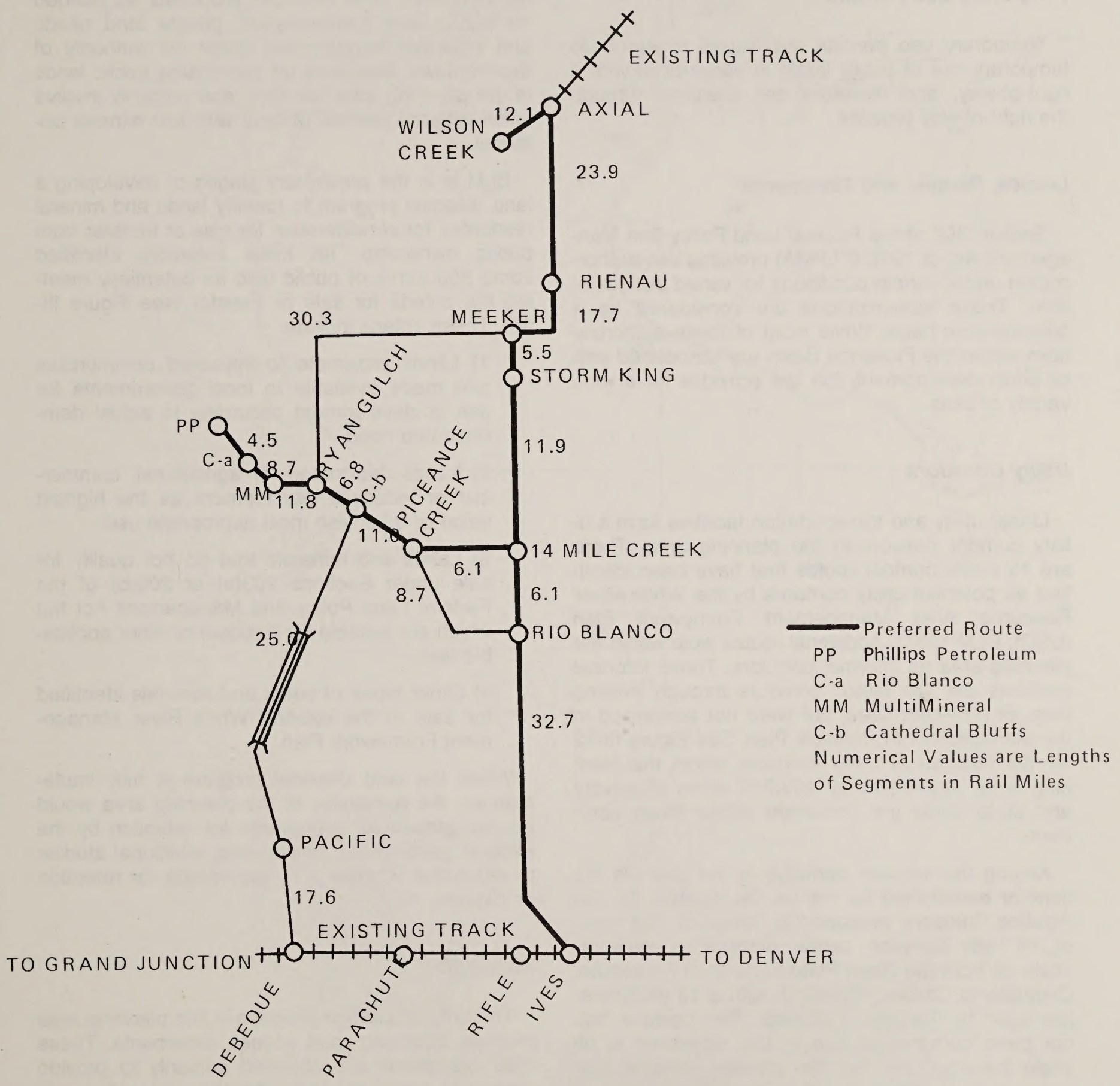


Figure III-11. Proposed Rail Segments

by the White River Resource Area staff as the need occurs. This process consists of a multiple-use conflict analysis and resource mitigation before authorization is offered.

Temporary Use Permits

Temporary use permits are issued to authorize temporary use of public lands in conjunction with a right-of-way, and therefore are analyzed through the right-of-way process.

Leases, Permits and Easements

Section 302 of the Federal Land Policy and Management Act of 1976 (FLPMA) provides use authorization under certain conditions for varied periods of time. These authorizations are considered on a case-by-case basis. While most of these authorizations within the Piceance Basin are associated with oil shale development, the law provides for a wide variety of uses.

Utility Corridors

Linear utility and transportation facilities form a utility corridor network in the planning area. There are 13 major corridor routes that have been identified as potential utility corridors by the White River Resource Area Management Framework Plan (USDI, BLM 1981). Additional routes exist within the planning area as informal corridors. These informal corridors are "de facto" corridors through existing uses or projected uses, but were not addressed in the Management Framework Plan. See Figure III-12 for the location of utility corridors within the planning area. Approximately 169,045 acres of private and state lands are contained within these corridors.

Among the informal corridors in the basin is the corridor established for the La Sal Pipeline. La Sal Pipeline Company proposed to construct 279 miles of 16 inch common carrier pipeline to transport shale oil from the Roan Plateau north of Parachute, Colorado to Casper, Wyoming, with a 12 inch pipeline spur to Rangely, Colorado. The pipeline has not been constructed due to the slowdown in oil shale development, but the corridor remains and may prove to be of significance when and if oil shale development accelerates. Utility corridors in the basin have never been formally designated.

Land Title Transfers

Sales

The current policy for the disposal of lands in the planning area is to consider proposals as needed for public land administration, private land needs and industrial development under the authority of existing laws. Requests for purchasing public lands in the planning area are rare, and primarily involve small isolated parcels of land with low mineral potential.

BLM is in the preliminary stages of developing a land disposal program to identify lands and mineral resources for consideration for sale or transfer from public ownership. An initial inventory identified some 850 acres of public land as potentially meeting the criteria for sale or transfer (see Figure III-13). These criteria include:

1) Lands proximate to impacted communities and made available to local governments for use or development according to actual demonstrated need.

2) Lands designated for agricultural, commercial or industrial development as the highest value or otherwise most appropriate use.

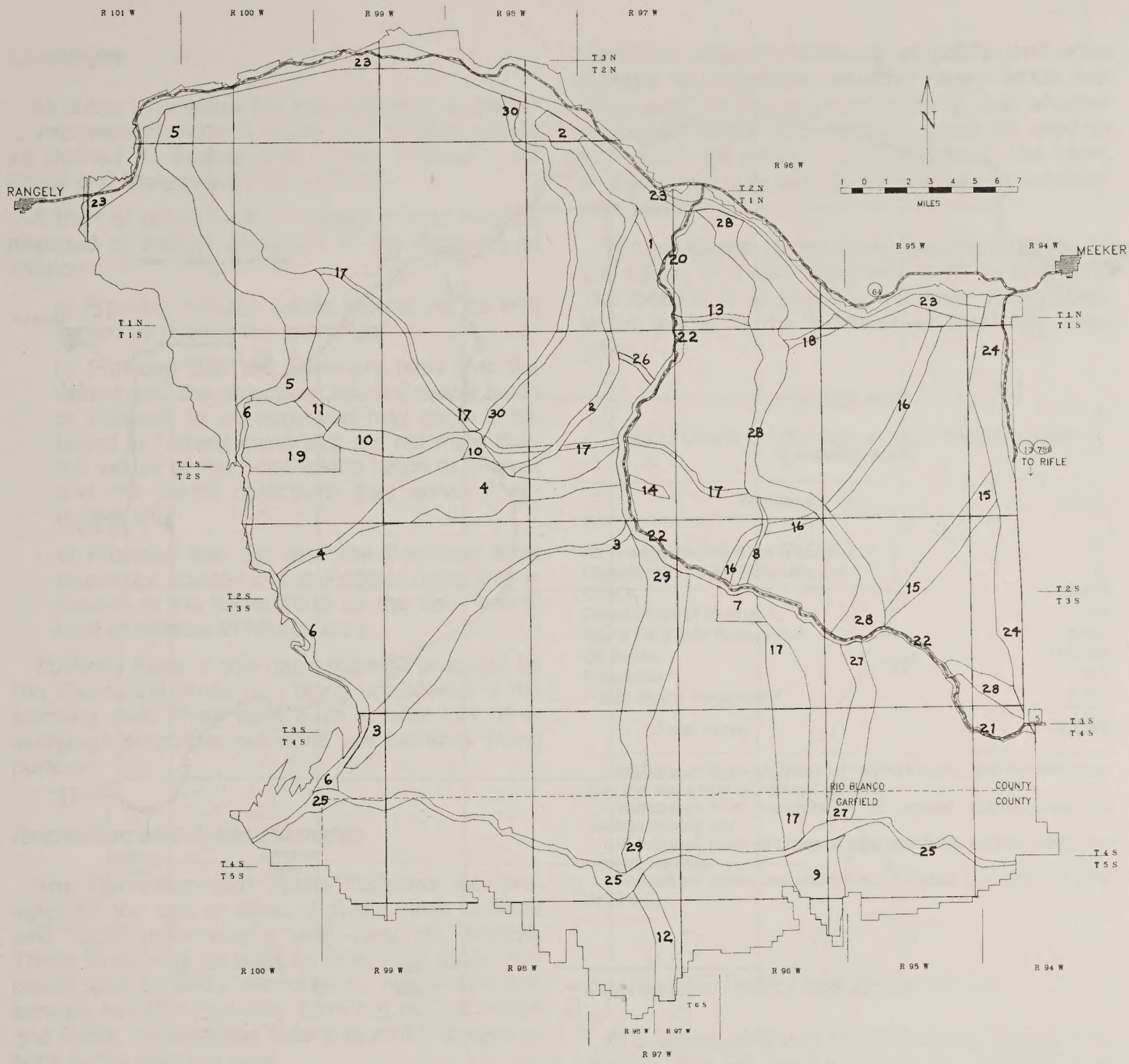
3) Lands and minerals that do not qualify for sale under Sections 203(a) or 209(b) of the Federal Land Policy and Management Act but which are suitable for disposal or other applicable law.

4) Other types of lands and minerals identified for sale in the existing White River Management Framework Plan.

When the land disposal program is fully implemented, the remainder of the planning area would be categorized as appropriate for retention by the Federal government, or requiring additional studies to determine whether it is appropriate for retention or disposal.

Acquisition

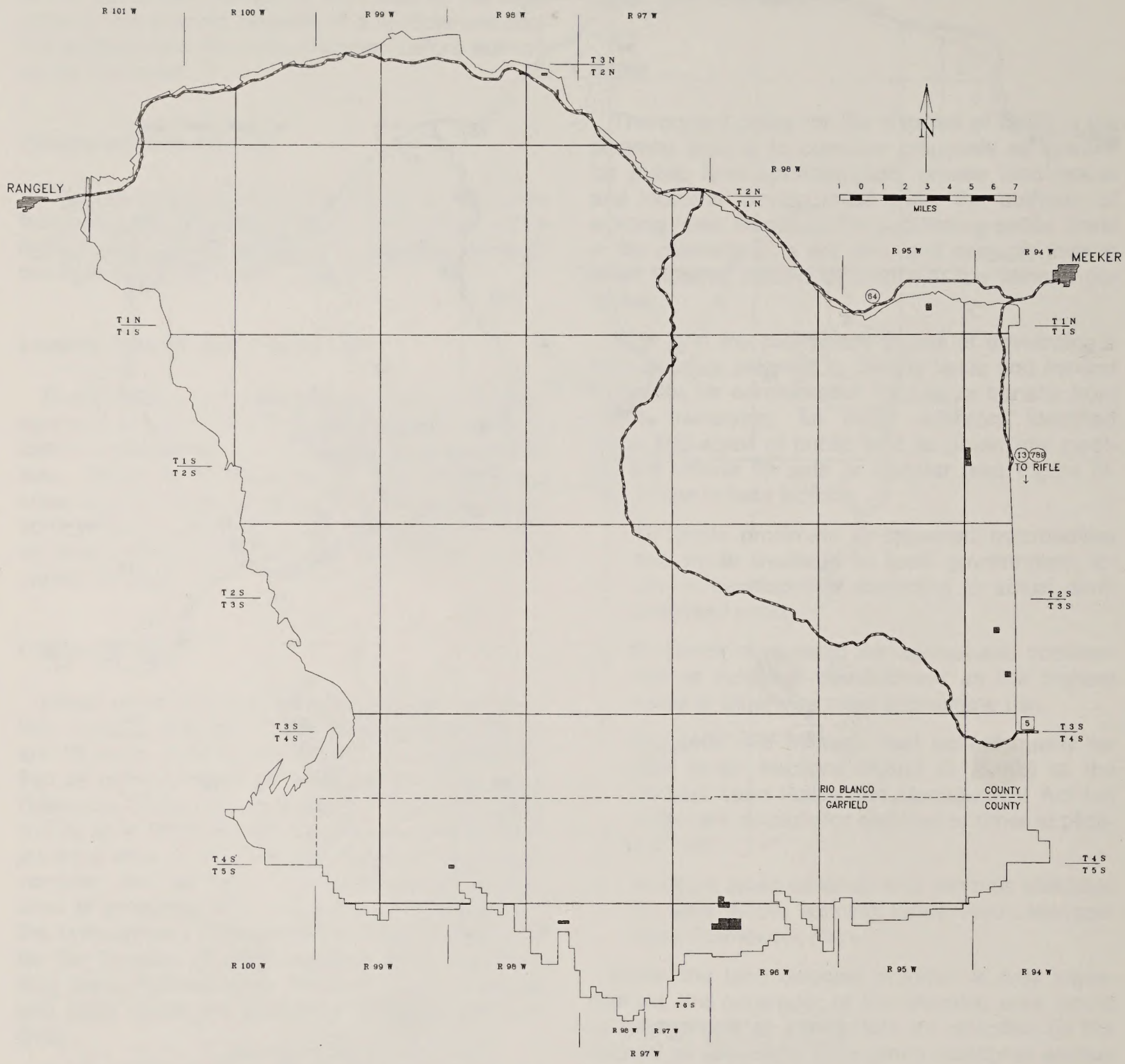
The only acquisition program in the planning area involves obtaining road access easements. These road easements are obtained primarily to provide access to public lands for hunting, recreation use and to enhance their manageability. Easement needs are identified by the resource program affected and are acquired as needed.



1.ALKALI FLATS
2.BAR D–BLAIR MESA,PL;TL;RD
3.BLACK SULPHUR CRK,PL;TL;RD
4.CA BLUFF–RYAN GUL,PL;TL;RD
5.CALAMITY RIDGE,PL;TL;RD
6.CATHEDRAL BLUFFS,PL;RD
7.CB CORRIDOR,PL;TL;RD
8.COLLINS GULCH,PL;TL;RD
9.COLONY OIL SHALE,PL;TL;RD
10.CORRAL GULCH,PL;TL;RD
11.COTTONWOOD DRAW,PL;TL;RD
12.DEBEQUE–ROAN PLATEAU,PL;TL
13.DRY FORK,PL;TL;RD
14.DUDLEY GULCH,PL;TL
15.JOE BUSH MTN,PL;TL
16.KENDALL POINT,TL
17.LA SAL,PL
18.LITTLE HILLS,PL;TL;RD
19.PHIL–DEAD HORSE RG,PL;TL;RD
20.PICEANCE CREEK NO.,RD
21.PICEANCE CREEK SO.,RD
22.PICEANCE CREEK,PL;TL;RD
23.RANGELY–MEEKER,PL;TL
24.RIFLE–MEEKER,PL;TL;RD
25.ROAN PLATEAU,PL;TL;RD
26.SQUARE S,PL;TL;RD
27.STORY GULCH,PL;TL;RD
28.WH RIV CITY–RIO BLANCO,PL;TL
29.WILLOW CREEK,PL;TL;RD
30.YELLOW CREEK,PL;TL;RD

LOCATION OF EXISTING AND POTENTIAL MAJOR LINEAR RIGHTS–OF–WAY (UNDESIGNATED CORRIDORS) FOR PIPELINES(PL), TRANSMISSION LINES(TL), AND ROADS(RD)

Figure III-12



Federal lands with potential for disposal

FEDERAL LANDS IDENTIFIED AS POTENTIALLY SUITABLE FOR DISPOSAL

Figure III-13

Exchanges

All public land within the planning area is subject to exchange provided it meets the following criteria as defined in Section 206 of the Federal Land Policy and Management Act of 1976:

A tract of public land or interest therein may be disposed of through exchange by the Secretary of Interior:

a) Provided that the public interest will be well served by making the exchange;

b) Provided that the Secretary finds that the values and the objectives which Federal lands or interests to be conveyed may serve if retained in Federal ownership are not more than the values of the non-Federal lands or interest and the public objectives they serve if acquired; and

c) Provided that the land the Secretary finds proper for transfer out of Federal ownership is located in the same state as the non-Federal land or interest to be acquired.

Currently there is only one exchange proposal, by Rio Blanco Oil Shale Co., being considered in the planning area. There have been at least four other exchange proposals but none are currently being pursued.

Recreation and Public Purposes

The Recreation and Public Purposes Act provides for the sale or lease of public lands to State and local governments and nonprofit entities. These lands may be used for numerous public purposes such as parks, picnic areas, rifle ranges and sanitary landfills. Presently there are no Recreation and Public Purpose Act leases or pending applications in the planning area.

Classifications

Lands classified for disposal will be limited to site specific proposals for recreation and public purposes and statutory land entries.

Withdrawals

Currently, some 610,388 acres of public land in the planning area are withdrawn for various purposes. The largest single withdrawal in the planning area is for oil shale which includes some 96 percent of the total withdrawn lands. Table III-8 shows the types of withdrawals currently identified in the planning area and the total acreage withdrawn.

BLM is currently reviewing all public land withdrawals to determine whether those lands are being used for the purposes intended, and whether other land tenure arrangements could be used to accomplish the intent of the withdrawal. The intent of this review is to revoke unnecessary or outdated withdrawals.

The withdrawal review is an on-going process, so the status of these withdrawn lands is changing. The location of all currently withdrawn public lands is on record in the White River Resource Area office.

TABLE III-8

PUBLIC LANDS WITHDRAWN IN THE PICEANCE BASIN PLANNING AREA

Withdrawal Type	Acres
Air Navigation Aid Sites (PLO 3822) [1]	20
Classification & Multiple Use Act [1]	21
Coal [2]	13,455
Department of Energy [3]	1,000
Naval Oil Shale Reserves [1]	4,163
Oil Shale [1]	586,343
Powersite [4]	266
Public Water Reserves [2]	5,120
Total Acres	610,388

[1] Withdrawn from all types of appropriation and mineral entry with the exception of mineral leasing.
[2] Withdrawn from nonmetaliferous mineral location under the general mining law.
[3] Withdrawn from all types of appropriation, mineral entry and mineral leasing.
[4] Withdrawn under the conditions of Public Law 359 (43 CFR 3730.0-3).

Coordination with Local Governments

In a Memorandum of Understanding approved on July 5, 1977, Rio Blanco County and the Bureau of Land Management agreed to coordinate their respective planning and decision processes in the preparation of Land Use Plans and Conditional Use Permits. This agreement involves coordinating applications for rights-of-way and other permitted uses of public lands. The interests of the private landowners are voiced through the County's Utility Corridor Committee which reports their findings to the County Planning Commission. The Planning Commission makes recommendations to the Board of County Commissioners for the final decision of Rio Blanco County to approve or reject Conditional Use Permit Applications. The BLM is not legally mandated to follow the County's recommendations, however it is the BLM, Colorado State Office policy that under the Memorandum of Understanding, County recommendations are fully considered in the Bu-

reau's final decisions. No formal agreement has been established with Garfield County.

Energy development is the dominant use factor influencing the volume of requests for lands and realty actions such as rights-of-way, exchanges, permits, easements and leases in the area.

Demand

Use Authorizations

Should energy development within the planning area, and throughout northwest Colorado increase, there will be a need for a variety of rights-of-way and the associated temporary use permits on public lands. Linear rights-of-way will continue to be needed throughout the planning area. As the needs arise, there will be the opportunity to consolidate them in existing and potential utility corridors.

Due to the anticipated energy development in the future, there will be an increase in the number of easements, permits and leases issued in association with that development.

Land Title Transfers

Within the planning area, nearly 850 acres of scattered public lands have been potentially identified for future disposal. Public lands in the vicinity of developable areas will also be considered for disposal as the necessity occurs.

Due to the minerals development within the area, there is a potential need for exchanges of private land and minerals with public land and minerals to enhance manageability. The demand for exchanges is expected to increase if mineral activity begins to increase.

With the probability of intensive minerals development there could be interest by state, local and county governments, and nonprofit organizations in obtaining public lands for recreation and public purposes.

The demand for major withdrawals should be non-existent in the future. Casework analysis will center on a comprehensive BLM review of all withdrawals.

Dependency

The distribution of public land causes locational dependencies by private and community entities. Due to the large blocks of public lands within the area, major transmission lines, pipelines and roads must be routed across public lands. A second type of locational dependency arises when ranches and towns are bordered or surrounded by public lands. The Bureau's programs of Recreation and Public Purpose actions and land disposals are intended to alleviate community expansion difficulties. Finally, lands suited for reservoir sites or lands with prominent points are often found suitable for communication sites. Most of these lands are located on BLM administered lands.

FIRE MANAGEMENT

Wildfire is a naturally occurring phenomenon in the planning area. Fires are usually the result of lightning striking a juniper or pinyon tree, causing ignition. The majority of fires are small, involving one to several trees and usually involve less than one acre. When fires do increase in size and burn out of control, it is usually during periods of extremely high air temperatures, low relative humidity, and low moisture content of trees and vegetation, and they occur in areas of high continuity of fuels. These larger fires typically burn in stands of pinyon-juniper and associated vegetation types such as sagebrush and grasslands. Fire occurrence is highest during late June, July and August.

To date, no fire management plan for the Piceance Basin Planning Area has been approved. Currently, all wildfires in the planning area are suppressed.

Extensive preparations are made every summer for emergency fire suppression. The BLM District office maintains a seasonal crew hired specifically for fire suppression. Permanent employees are also assigned to fire teams which are on call throughout the fire season. Temporary employees are trained and equipped to assist as necessary.

Fire fighting vehicles and equipment are maintained to support these crews, and on-call support is available for fire suppression from other BLM offices and other Federal agencies in Colorado and throughout the west.

The present wildfire policy was established in the White River Resource Area Management Framework Plan (USDI, BLM 1981). This guidance is an interim fire management policy, and is in effect until an approved fire management plan is written for the planning area. The need for a fire management plan is recognized in the Management Framework Plan and supported by recommendations from the range, wildlife, watershed and wild horse programs. The cooperative fire management agreement between BLM, U.S. Forest Service and the National Park Service calls for agency exchange of fire management plans. The preparation of a plan is sched-

uled following completion of the Resource Management Plan.

Fire management is not limited to wildfire, but also extends to the use of fire in the form of prescribed burning. This is primarily a method of vegetation manipulation. Prescribed burn policies and planned accomplishments are included in the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980) and in the Bureaus Air Quality Maintenance requirements. A prescribed burn plan for the planning area was approved in 1982. Currently, approximately 1,000 acres per year are designated for burning, the majority of which will occur in sagebrush and pinyon-juniper vegetation types.

Air quality maintenance for prescribed burns requires an approved burning permit from the State of Colorado, Department of Health, Air Pollution Control Division. These permits prohibit prescribed burning on days that smoke dispersion would be graded at four or less. Smoke dispersion ratings are determined by the U.S. Weather Bureau daily smoke dispersion forecasts. Air quality maintenance for natural fires requires the Federal land manager to notify the Air Pollution Control Division when such a fire is in progress and when its suppressed or has died out naturally. This policy will be addressed in the Fire Management Plan when developed.

Demand and Dependency

Local communities and industries depend upon the BLM to provide adequate fire management to prevent fires from burning onto private land or facilities. The use of fire as a management tool for vegetation manipulation is expected to increase.

SPECIAL MANAGEMENT AREAS

There are no existing Research Natural Areas, Outstanding Natural Areas or Areas of Critical Environmental Concern in the Piceance Basin Planning Area.

WILDLIFE ALTERNATIVE

The goal of this alternative is to emphasize the management and use of the public lands for the benefit of wildlife and related values. Significant surface disturbing activities and other actions that would adversely affect important wildlife habitat would be discouraged.

Management actions that serve to maintain or enhance habitat available to all wildlife would be encouraged. This alternative would result in a reduction in surface disturbing activities, improved forage, a maintenance of water quality, and the protection of fragile and productive soils. Other resource values that would benefit from these objectives would similarly benefit from implementation of this alternative.

AIR RESOURCE MANAGEMENT

Basic management activities as described in the Current Management Alternative would continue including monitoring, analysis, permit compliance, impact mitigation and management of the resource for minimal impact.

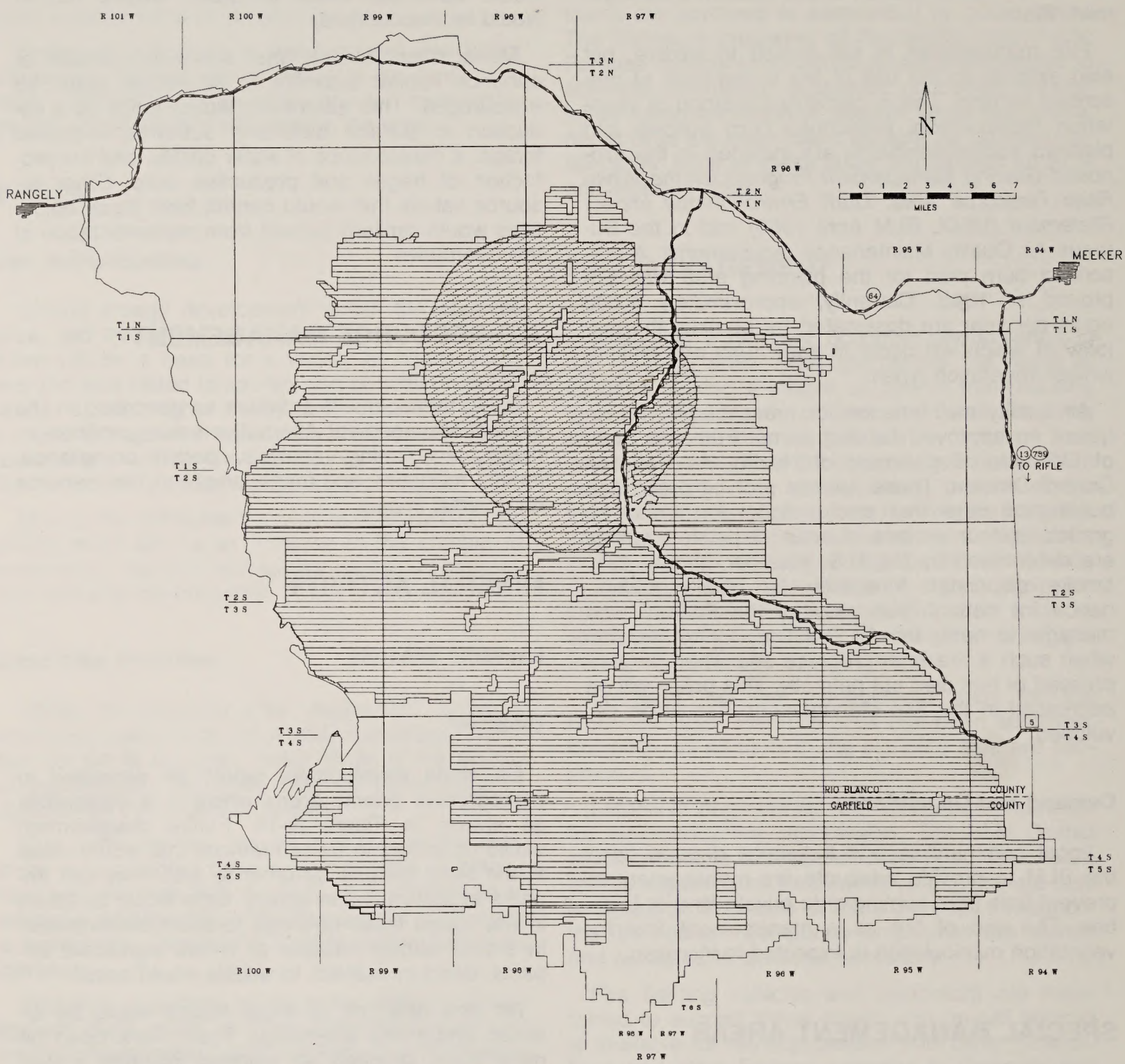
MINERAL ACTIVITY

Leasable Minerals

Oil Shale

Oil shale development would be permitted in management priority areas where it is compatible as shown in Figure III-14. Future development would be limited to those methods that would result in the least surface disturbance with minimum impacts to surface water quality. Care would be taken in any future lease offerings to avoid development in critical wildlife habitats or where significant impacts, direct or indirect, to wildlife would occur.

No new open pit oil shale leases would be allowed under this alternative. Tract C-a's open pit mine could proceed as planned including offsite disposal as legislatively authorized. As C-a's active mine face approaches the lease boundary to the south and east, evaluation of the impacts of expanding the pit should be conducted. Additional leasing to expand the existing mine could be considered as long as backfilling into the existing pit could continue, and no critical wildlife values would be lost. The value of the pit and the active mine face could be transferred to future lessees of adjacent tracts through negotiation mediated by the Bureau of Land Management. Those leases would utilize the developed pit on C-a for backfill and continue the migrating pit to the southeast. No additional offsite leases for disposal of spent shale would be allowed under this alternative. Provision



LANDS AVAILABLE FOR OIL SHALE LEASING
WILDLIFE ALTERNATIVE

Figure III-14

for spent shale and overburden disposal would be included on lease tracts.

Underground oil shale development must minimize surface disturbing activities, and limit the total area of disturbance at any given time during mine development. As existing oil shale development proves successful and the demand for Federal tracts increases, additional tracts could be considered as recommended by the Regional Oil Shale Team and input from the public. Preference would be given to industry proposals for oil shale development methods that minimize surface disturbance.

Oil shale development in compatible management priority areas for multimineral development would require the development of sodium minerals concurrently or sequentially with oil shale. If developed sequentially, stockpiling of sodium must be minimized. In addition, the above discussion of underground mining would also apply to multimineral development.

In any case, no additional leasing would be considered until the existing prototype tracts (C-a, C-b and either C-11 or C-18) are proven successful and are operating commercially. Once commercial production is achieved and additional demand for Federal oil shale leasing increases, expressions of industry interest would be sought and tracts delineated as indicated above. Site-specific tract analyses would then be conducted as required by NEPA. The lands available for future oil shale leasing under this alternative are shown in Figure III-14. While this area is large, it should be emphasized that not all of this land will be leased, but would be available for future leasing given the constraints of this alternative. Critical wildlife habitat, areas of low air pollution dispersion, aquifer recharge zones, and other areas with avoidable environmental concerns shall not be offered unless adequate mitigation or site location can be provided as determined during the tract delineation process.

In order to pace potential impacts and phase growth, no more than one tract would be leased within any five year period. The first lease offering would not be considered until a determination is made by the BLM that the existing Federal leases are operating successfully and producing commercially.

Oil shale land exchanges would be considered only as long as important wildlife habitat values are not reduced. Exchanges that are proposed by industry to consolidate private lands for oil shale development shall be considered within the lease limit. In other words, private oil shale development resulting from an exchange may take the place of a lease.

Small research tracts would be considered by BLM on the merits of the technology proposed by the applicant. Consideration of such research leases would include a determination of the appropriateness of the oil shale resource for the technology-testing that is proposed, the availability of such deposits on non-Federal lands, the potential environmental and socioeconomic impacts of such a lease and a determination of whether the lease is in the public interest. No commercial-scale operations would be considered under this provision. While tract size is not specified, it is anticipated that research leases would not exceed 1,000 acres. Research tracts for technology-testing would not be counted against the lease limit.

Sodium

All public lands in the planning area would be excluded from further sodium mineral leasing except in conjunction with oil shale multimineral leasing. Only the existing sodium leases and any sodium Preference Right Lease Applications (PRLAs) that are leased would be allowed to develop sodium minerals. Site-specific leasing restrictions to protect other resources would be imposed prior to lease approval and exploration of the PRLAs where other resources were shown as having priority. Standard lease stipulations would apply as stated in the existing sodium leases.

Coal

Emphasis on leasing Federal coal would continue as needed to support existing mines adjacent to the planning area, and future mines on existing leases. Any additional acreage made available for leasing would be limited to lands identified as acceptable for subsurface coal development, approximately 29,610 acres. Site-specific restrictions would be imposed to protect wildlife habitat and other critical resource values. These restrictions would become part of the lease on approved mine plans only coal development by subsurface mining methods would be allowed. Lands identified as unacceptable for any mining method in the *Coal Amendment to the White River Resource Area Land Use Plan* (USDI, BLM December 1981b), would be excluded from future coal leasing consideration.

Oil and Gas

All public lands in the planning area would continue to remain open to oil and gas leasing except for lands protected in the public interest for other important resource values such as critical wildlife

habitat, Areas of Critical Environmental Concern, cultural sites, recreation sites, etc. As leases expire in these areas, these other resource values would be considered prior to lease reissuance. Additional stipulations such as no surface occupancy or seasonal restrictions may be imposed on new or reissued leases based on these values. If protection still cannot be assured through such restrictions, not reissuing the lease may be considered.

Known Geologic Structures which have the greatest potential for development would be committed to the exploration and development of oil and gas resources. Standard oil and gas lease stipulations would be applied to these areas. In addition, site-specific or temporary restrictions specified in the *White River Resource Area Oil and Gas Leasing Umbrella Environmental Assessment* (USDI, BLM February 1982) would be imposed prior to leasing or exploration to protect other important resources, and to plan for a more orderly development of the existing oil and gas resource.

Locatable Minerals

All public lands in the planning area would remain open to entry for exploration, location and development of locatable minerals under the provisions of the General Mining Law of 1872 as amended, except those lands under protective withdrawal that would be excluded from mineral entry. Lands classified for disposal under the Recreation and Public Purposes Act are also closed to mineral entry (see Lands and Realty Section). Development and certain types of exploration could have site-specific or temporary restrictions imposed to protect other important resource values.

Saleable Minerals

The public lands would be available to provide mineral materials to meet the demands not filled by private enterprise and would provide free materials to local, state and Federal agencies for road maintenance and construction. Existing or previously used sites would be favored. Sand and gravel development would be excluded in areas of rare or sensitive plants, important fish and wildlife habitat, riparian areas, fragile soils, sensitive watersheds and special management areas. Site-specific restrictions would be required to protect other resource values.

WATER RESOURCES

Upon completion of the 1984-1985 stream channel stability inventories (see Current Management Alternative), all streams on public lands in the planning area that meet or exceed state water quality standards and have acceptable channel stability will be maintained in their present condition through management practices such as:

1. Monitor water quality or stream bank stability.
2. Improve vegetation cover on watersheds by developing grazing systems for livestock that would provide an increase in plant density and stabilize the soil.
3. Initiate streambank stabilization projects.
4. Restrict the use of riparian areas by livestock to protect riparian habitat and to promote streambank stability.
5. Construct check dams on intermittent stream drainages to reduce sediment load caused by upland erosion.
6. Apply recommendations made in the Northwest 208 Plan to Bureau water quality control and improvement projects if feasible. Insure that the best management practices available are incorporated.

Streams not meeting State standards would be improved by application of these management practices to meet the minimum standards, provided they meet the following criteria for intensive management:

1. Twenty percent or more of the watershed is in a moderate to severe erosion class (sensitive watersheds).
2. The land pattern is such that watershed improvement projects initiated by BLM would have a noticeable effect on improving the water quality.
3. The pollution source is on public land.
4. Fish and wildlife would benefit from channel stability.

The Bureau would cooperate with other agencies or adjacent landowners to improve water quality on a case-by-case basis for streams that do not meet the State standards and do not fulfill the criteria for intensive management.

Groundwater would be protected to maintain present quality. This would be achieved by placing restrictions on activities that may penetrate into subterranean water. Degradation by toxins and other impurities would be regulated by present

management practices, additional stipulations would be placed on groundwater usage and disposal on a case-by-case basis.

Sensitive watersheds would be identified through watershed management plans and protected by placing restrictions on activities that may adversely affect them. Improvements to sensitive watersheds would be accomplished through intensive management practices initiated by other resource programs. Certain forms of mechanical stabilization and vegetation treatments would be undertaken. Stream channels and riparian zones would be improved as needed.

Sensitive watersheds, as well as streams that meet the minimum standards, would be protected by imposing the following restrictions on use of public lands:

1. Exclude surface disturbing activities from sensitive watersheds where they were contributing to, or had the potential for contributing to, degradation of water quality.

2. Provide buffer strips between streams and surface disturbing activities, such as mining; road building, clearcutting trees, etc.

3. Ensure rapid revegetation of disturbed areas.

4. Utilize water course structural engineering practices (gully plugs, gabion structures, dams, riprap, etc.) where applicable.

5. Limit ORV usage in sensitive watersheds.

6. Control erosion or runoff on disturbed sites.

7. Limit vegetation manipulations or treatments in sensitive watersheds to spraying, aerial seeding or designed grazing systems.

8. Place time restrictions on surface disturbing activities to avoid spring thaw and runoff seasons.

9. Construct snow management structures for all watershed improvements where practical.

10. Comply with all Federal, state and local water quality regulations.

SOILS

Emphasis would be directed towards maximizing productivity of the soil resource. Disturbances on fragile or productive soils would be avoided or carefully regulated through application of special reclamation stipulations. Less restrictive stipulations would be required on surface disturbing activities occurring on other soil types. Seasonal road closures would be enforced during periods when the soil surface (top three inches) is saturated. An improved road maintenance program would be implemented to minimize erosion losses. Watershed activity plans would be developed and implemented to stabilize sensitive watersheds and monitor soil erosion losses for the entire planning area. No surface occupancy stipulations would be applied to Badlands (5) and Rock outcrop (78) soil mapping units. Studies would be needed for monitoring sediment yields to determine resource benefits from the existing program and to identify program deficiencies.

FORESTRY

Objectives for sawtimber and pinyon-juniper are to manage, in perpetuity, forested areas on a sustained annual yield basis. This also includes managing forested areas for multiple resource values. Specific management actions would be identified through preparation of a comprehensive forest management plan.

Objectives would be achieved primarily through the sale of forest products. This would be implemented through advertised and negotiated commercial sales and individual negotiated sales. The current White River Resource Area's 5-year sale plan identifies the annual commercial sale of approximately 2,500 cords of pinyon-juniper firewood and 250,000 board feet of Douglas fir sawtimber. Compliance checks would be necessary on all existing and proposed timber sales. Additional product sales to individuals would be handled on a case-by-case basis.

When energy development actions impact forested areas, developers would be required to purchase all timber products prior to project commencement. Stipulations for timber disposal and rehabilitation of these project sites would be included on each development action.

LIVESTOCK GRAZING

Forage allocation to livestock would be increased from the current maximum authorized use of 57,016 AUMs to 63,724 AUMs over the long-term.

Allotment Management Plans (AMPs) would be developed for each allotment in the study area. Two categories of AMPs are proposed: intensive and less intensive.

Five allotments are presently under intensive management with developed AMPs and would continue to be managed this way: Dry Fork, Segar

Gulch, Piceance Mountain, Reagles and Square S. Intensive management and development of AMPs would be initiated on 24 additional allotments. Grazing systems and specific range improvements would be identified as AMPs are developed. Allotment Management Plans would be designed to coordinate livestock grazing with other land uses to meet multiple use objectives. Intensive monitoring and study programs would be conducted on each allotment proposed for intensive management.

Less intensive management is proposed for Lower Fourteen Mile, Puckett Gulch and Pine Knott Gulch, Powerline and Skinner Ridge allotments. These allotments involve small acreages of public land making it impractical or uneconomical to administer the intensive management practices identified above.

Implementation of AMPs was originally scheduled for completion by 1988 in the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980). However, based on present funding levels full implementation may not be achieved until the year 2000.

The White River Trail would continue to be available for livestock trailing. Mitigation of impacts due to energy development would be required.

WILD HORSES

Wild horses would be managed to maintain a herd population of 65-100 by 1988. This would require a forage allocation of between 1,040-1,600 Animal Unit Months (AUMs). Since an estimated 159 wild horses currently reside in the planning area, removal operations would be required to reduce populations to desired levels. Follow-up horse removal operations would be necessary to maintain populations within this level. Projects would be implemented to provide forage and water to sustain this herd. Mitigation of negative impacts due to energy development would be required.

WILDLIFE

Wildlife habitat would be intensively managed to optimize wildlife populations. A larger quantity of forage would be allocated to increase mule deer and elk populations by 23 percent and 8 percent, respectively. Initial (short-term) forage allocation to wildlife would be 36,253 AUMs and expanded to 48,632 AUMs over a 20 year period. Prior to the expansion of big game wintering herds, additional production of winter forage would be necessary and accomplished through land treatments.

Wildlife habitat improvement projects would be directed to increase production and condition of big game winter forage, improve distribution and availability of water on big game summer ranges, and improve condition of riparian habitat. Off road vehicle (ORV) restrictions would be enforced during crucial time periods on essential wildlife habitat areas to minimize disturbances. Research efforts would be expanded to collect necessary data for improved management. A detailed wildlife habitat monitoring system would be developed and implemented for the entire planning area.

Livestock management and range improvement projects would be designed to enhance wildlife resource values. Wild horse populations would be controlled on the designated Herd Management Area to minimize competition with wildlife. Forest product sales would be located and designed to improve wildlife habitat conditions. A Fire Management Plan would be implemented to allow beneficial effects of wildfire in designated areas. Stringent restrictions would be enforced on all energy development actions to minimize adverse impacts to wildlife habitat. An Industrial Association would be recommended to better coordinate mitigation efforts and improve technology to reduce site specific and cumulative impacts to the wildlife resource from energy development.

THREATENED, ENDANGERED, RARE AND SENSITIVE PLANTS AND REMNANT VEGETATION ASSOCIATIONS

All known populations of rare and sensitive plants would be protected. Uses or activities that would adversely impact these plants or their habitats would be excluded. Remnant vegetation associations would also be protected from any surface disturbing activity that would result in adverse impacts. On-the-ground surveys by a qualified specialist would be required for actions in areas of known or potential habitat on public land prior to any surface disturbing activity. For more detail on management of these resources, please refer to Appendix B.

CULTURAL RESOURCES

Intensive management of cultural resources would include all aspects of current management

(see Current Management Alternative). In addition, management would involve analysis of the cultural resources in the planning area and adequate interpretation. This would provide a clearer understanding of the extent and significance of the resources present and would answer regional research questions.

The management practices to be employed would include the following:

Analysis - A representative sampling of cultural sites would be excavated and analyzed in order to answer regional research design questions.

Interpretation - An interpretive program would include the installation of informational signs at major site locations which would explain the resource. A permanent display would be installed in the lobby of the White River Resource Area office building which would exhibit artifacts and reproductions of rock art in the area.

Public Awareness - Public education would be used to reduce vandalism of cultural sites on public lands. This would include the use of informational signs, talks to community and school groups, and publication of educational brochures.

PALEONTOLOGICAL RESOURCES

Paleontological resources would be managed according to the classification scheme described in the Current Management Alternative. This program would include future inventory, analysis, permitting, impact mitigation and management of the resource for commercial and recreational collecting.

RECREATION

Under intensive management, user areas and services providing for the health, safety and convenience of the public and protection of resources would be actively managed. Hunting concentration areas would be proposed as a Special Recreation Management Area (SRMA) (see Figure III-15). The rest of the planning area would be managed as an Extensive Recreation Management Area (ERMA). Recreation sites would be developed in the SRMA as use and need increases, emphasizing protection and maintenance of the quality of the user experience.

Hunter camps would be designated in the SRMA by signing and/or development in order to accommodate existing use and protect the resource. Access and parking in high use areas would be improved. A seasonal visitor services program for hunters would be established which would include use supervision and roadside information stations. Public access points along the White River would be identified, signed and sequentially developed as use increases. This would provide more capacity for recreation in a rural water oriented setting and help meet user demand.

Some 10,000 acres of resource conflicts would be permanently closed to off road vehicle (ORV) use to reduce or eliminate adverse impacts to Special Management Areas. Another 177,000 acres would be seasonally closed or restricted to travel only on existing roads and trails. Administrative and operational actions would be taken to facilitate road closures. Off-Road Vehicle designations, including seasonal closures, would be proposed to protect Special Management Areas and crucial wildlife habitat. A Non-motorized Hunting Area of approximately 2,000 to 5,000 acres would be established within the Cow Creek unit of the SRMA. This area would be closed to motorized vehicles during the big game hunting season (approximately 3 months). Further details on the ORV designations are located in Appendix C.

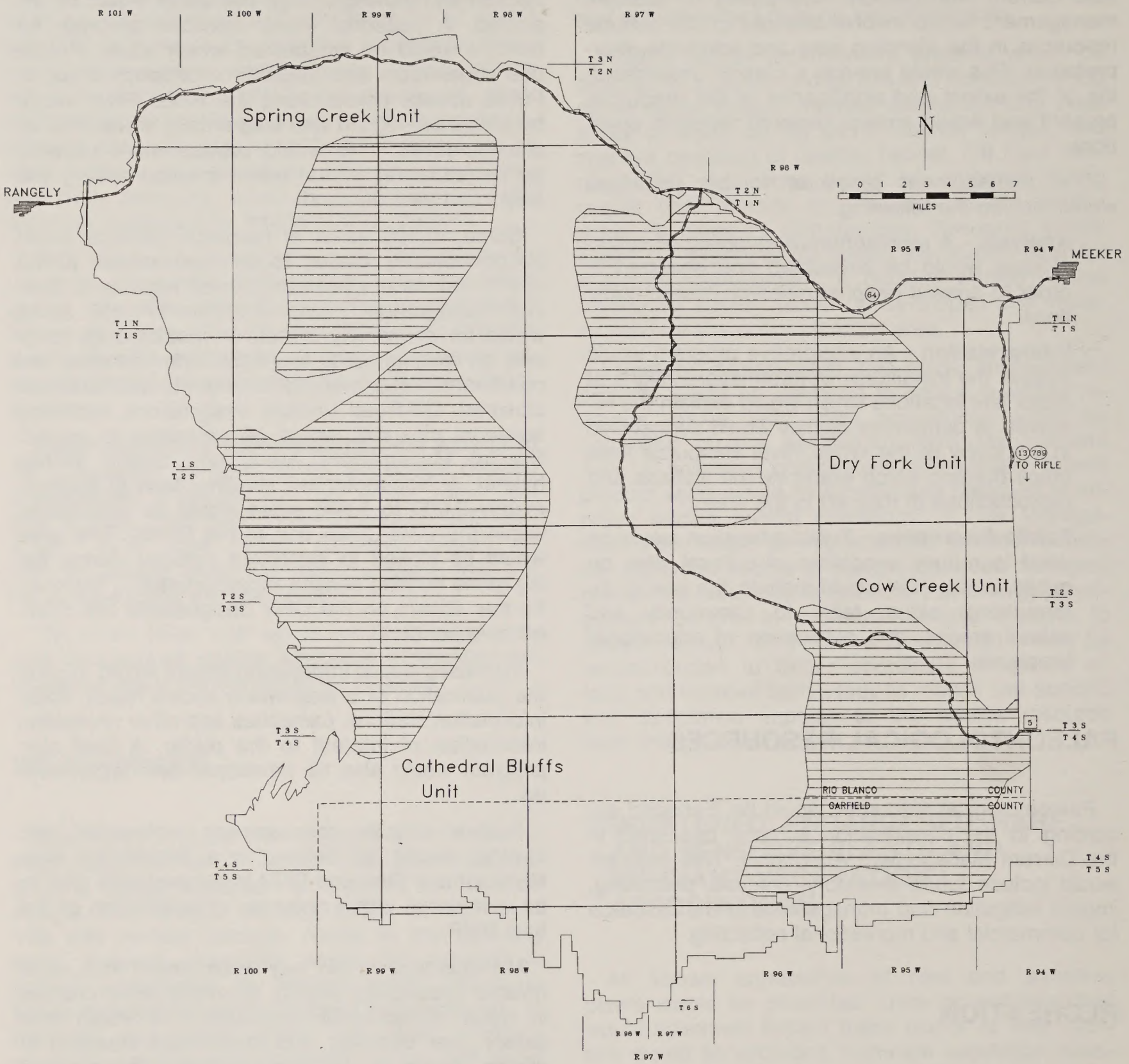
Increased public information efforts would include the publication of a map which shows roads, trails, information stations, campsites and other recreation information of interest to the public. A road sign program would also be developed and implemented.

Further specific management techniques and strategy would be defined in a Recreation Area Management Plan and ORV implementation plan to be completed within one year of publication of the final RMP.

Management in this way would result in a more diverse opportunity setting, providing more choices in types of recreation available. This would help satisfy user demand, and allow more freedom of choice. Areas of the semi-primitive non-motorized opportunities would be added to the base. Once the non-motorized areas are established, recreation management objectives would be to maintain the Recreation Opportunity Spectrum (ROS) classes within the SRMA. Objectives of the Colorado State Outdoor Recreation Plan would be met for all identified priority management, including nature study, picnicking, ORV use and camping.

VISUAL RESOURCES

Visual resource management (VRM) would remain a support activity for other resource pro-



SPECIAL RECREATION MANAGEMENT AREA

Figure III-15

grams and subactivities. Visual design would be emphasized as a means to reduce the contrast of projects with moderate to high impacts or projects which are proposed in sensitive areas.

The contrast rating system, as described in the revised BLM policy guidelines for VRM (IM No. CO-83-234), would be implemented. It is the responsibility of the program which is initiating development activity, to ensure that visual values are adequately maintained.

TRANSPORTATION

Criteria for transportation management are outlined in the following documents:

- BLM Manual Sec. 9112 (Bridges and Culverts) and Sec. 9113 (Roads);
- Craig District Transportation Plan;
- White River Resource Area Oil and Gas Umbrella Environmental Assessment;
- Surface Operating Standards for Oil and Gas Development; and
- Site-specific stipulations developed through right-of-way applications, Applications for Permit to Drill (APDs) and mining plans.

Existing transportation systems would be sufficient to handle current access needs for multiple use management. The District Transportation Plan (secondary roadways) would be updated to plan for the needs of the Piceance Basin. Unnecessary roads would be abandoned and reclaimed. Coordination with state and county road development would be facilitated through Memoranda of Understanding. Improvement of existing state and county (primary) roadways would be facilitated by making the public lands available for sand and gravel resources. Submission of a Five Year Plan of Development for oil and gas fields as described in the existing *White River Oil and Gas Umbrella Environmental Assessment* would be required and made a lease stipulation for new or reissued leases in order to assist BLM in identifying and mitigating the cumulative impacts of access roads and pipelines. The construction of new access roads, pipelines, transmission lines and other transportation needs would be encouraged, through the permitting process, to be placed in designated utility corridors.

LANDS AND REALTY

Use Authorizations

Applications for use authorizations would be processed and approved on a case-by-case basis. Locations and routes would be situated in an economically and environmentally sound manner emphasizing development on previously disturbed sites and/or designated utility corridors. Use authorizations include temporary use permits, rights-of-way, permits, leases, easements and communication sites. Use authorization actions could include access roads, pipelines, powerlines, utilities and railroads and must meet the following criteria:

1) Applications must meet the requirements of existing law and Bureau policy.

2) Placement on or use of the public lands must not be in conflict with the lands specific to critical resource needs, their buffer zones, or protection of those areas.

3) Applications should support private or governmental needs on a local or regional basis.

Applications for use authorizations would be processed and approved if they did not adversely impact critical wildlife use areas or other environmental values of the area, including threatened or endangered species habitat and significant cultural resource sites.

Major linear rights-of-way such as highways, pipelines and transmission lines would be located, whenever possible, within designated corridors. These corridors are located to avoid impacting wildlife and livestock management priority areas. Steep topography, poor soils, high visual sensitivity, known rare or sensitive plant locations, threatened or endangered species habitats, cultural sites or other fragile areas would be avoided. These corridors are identified on the Wildlife Alternative Map (see Map Addendum), and would be formally designated through approval of this plan. Applicants would be encouraged to locate facilities within these corridors. Use of the designated corridors provides the opportunity to use the NEPA Categorical Exclusion process and reduces the time and cost of processing the right-of-way application. Designation of a corridor within the energy and mineral management priority areas would preclude any mining unless sufficient pillar support was designed in the mine plan to prevent subsidence. Following is a description of the proposed corridors, their designated uses (see Figure III-12 for location), and the environmental review (if any) necessary for each use. These corridors are also shown on the Wildlife Alternative map in the Map Addendum.

Bar D Mesa-Blair Mesa -- Starting in the middle of the basin, this corridor is located on the divide between Yellow and Piceance Creeks and heads north to the White River. This corridor would be designated for major pipeline, utility and road transportation use. A detailed environmental review would be necessary for liquid product, gas and electrical transmission lines use. Road transportation use would require an environmental review only in the northern portion of the corridor.

Calamity Ridge -- This corridor is located on the northwest edge of the basin and heads north to the White River following the Calamity Ridge Road. This corridor would be designated for major pipeline, utility and road transportation use. A detailed environmental review would be necessary for liquid product and gas pipeline use.

Cathedral Bluffs -- Located on the west boundary of the basin, this corridor heads south from the Calamity Ridge corridor to the Roan Plateau corridor. This corridor would be designated for major pipeline and road transportation use. A detailed environmental review would be necessary for liquid product and gas pipeline use.

Cathedral Bluffs-Ryan Gulch -- At the junction of Ryan Gulch, and Piceance Creek to Dudley Gulch, this corridor heads west up Ryan Gulch to Bar D Mesa. Encompassing the west half of Bar D Mesa, the corridor heads west to Wolf Ridge where it ends at the boundary of Prototype Tract C-a. This corridor would be designated for major pipeline, utility and road transportation use. A detailed environmental review would be necessary for liquid product, gas, utility and road transportation use. A detailed review for road transportation use would only be required from Bar D Mesa west to Tract C-a.

C-b -- This corridor is located between Piceance Creek and the north side of Tract C-b. This corridor would be designated for major pipeline, utility and road transportation use.

Collins Gulch -- This is a short corridor located north of the C-b corridor and Piceance Creek and heads north up Collins Gulch toward Magnolia Camp. This corridor would be designated for major pipeline, utility, and road transportation use. A detailed environmental review would be necessary for electrical transmission line use.

Colony -- This corridor is located on the southeast rim of the basin and runs south from the Roan Plateau corridor to Parachute Creek. This corridor would be designated for major pipeline, utility and road transportation use. A detailed environmental review would be necessary for electrical transmission lines and road transportation use.

Corral Gulch -- Starting at the junction of Stake Springs Draw and the Cathedral Bluffs-Ryan Gulch corridor, this corridor heads north to the confluence of Stake Springs Draw, Corral Gulch and Yellow Creek. From this point the corridor heads west up Corral Gulch to the confluence with Box Elder Gulch where it stays to the north side of the Corral Gulch until it ends on Dead Horse Ridge. This corridor would be designated for major pipeline, utility line and road transportation use. A detailed environmental review would be necessary for liquid product and gas transmission line use. A detailed environmental review would only be necessary for electrical transmission line use from the confluence of Corral and Box Elder Gulches east. A detailed review would also be necessary for road transportation from the aforementioned confluence west to Dead Horse Ridge and from the confluence of Stake Springs Draw and Yellow Creek south.

DeBeque-Roan Plateau -- This corridor starts at the junction of the Roan Plateau corridor and the head of East Willow Creek, it then proceeds south down Pearl Creek to the head of Deer Park Gulch. This corridor would be designated for major pipeline and utility transmission use. A detailed environmental review would be necessary for liquid product, gas and electrical transmission lines.

Dudley Gulch -- This corridor starts at the junction of the Piceance Creek Corridor and Dudley Gulch and heads east up Dudley Gulch. This corridor would be designated for major pipelines and utility use. A detailed environmental review would be necessary for electrical transmission lines.

Joe Bush Mountain -- Starts on the east side of the basin and heads southwest to Piceance Creek and the White River City-Rio Blanco corridor. This corridor would be designated for major pipeline and utility transmission line use. A detailed environmental review would be necessary for electrical transmission lines. Liquid product and gas transmission lines would need a detailed environmental review in the northern portion only.

La Sal -- This corridor starts in the southeast portion of the basin connecting with the Roan Plateau and Colony corridors and heads north to Magnolia Camp, then west to the open pit mine area and then northwest to the Calamity Ridge corridor. This corridor would be designated for major liquid product and gas transmission lines.

Little Hills -- This corridor is located in the northeast part of the basin and connects the White River City-Rio Blanco corridor in a northeast direction to the Rifle-Meeker corridor. This corridor would be designated for major pipelines, utility and road transportation use. A detailed environmental review would be necessary for electrical transmission lines.

Piceance Creek -- Beginning at the junction of Piceance Creek and Dry Fork, this corridor heads south paralleling and including Piceance Creek road until it ends at the junction of Piceance Creek and Deer Creek. This corridor would be designated for major pipeline, utility and road transportation use. A detailed environmental review would be necessary for liquid product, gas and electrical transmission line use.

Piceance Creek North -- Starting at the junction of Highway 64 and Piceance Creek road this corridor parallels and includes Piceance Creek Road until it meets the Piceance Creek corridor. The corridor ends at the junction of Piceance Creek and Dry Fork. This corridor would be designated for major road use. A detailed environmental review would be necessary if the existing road use undergoes major upgrading.

Piceance Creek South -- Beginning where the Piceance Creek corridor ends, this corridor parallels and includes Piceance Creek Road and heads southeast until it joins the Rifle-Meeker corridor. This corridor would be designated for road transportation use. A detailed environmental review would be necessary if the existing road use undergoes major upgrading.

Rangely-Meeker -- This corridor starts at the extreme northeast corner of the planning area in Powell Park and heads west towards, Rangely; paralleling the north boundary of the planning area along the White River and Highway 64. This corridor would be designated for major pipeline and utility line use.

Rifle-Meeker -- This corridor heads south from Meeker along highway 13 on the east side of the basin towards Rifle. This corridor would be designated for major pipeline, utility and road transportation use.

Rifle-Roan Plateau -- Starting at the extreme southeast corner of the basin this corridor heads west along the Roan Plateau to the far southwest corner of the basin. This corridor would be designated for major pipeline, utility and road transportation use. A detailed environmental review would be necessary for electrical, liquid product and gas transmission lines.

White River City-Rio Blanco -- This corridor starts at approximately the junction of Highway 64 and Rio Blanco County road 5 and heads south to Magnolia Camp. From Magnolia Camp it heads southeast to Piceance Creek. This corridor is being designated for major pipeline, utility and road transportation. A detailed environmental review would be necessary for electrical transmission lines and partially in the northern portion for liquid product and gas transmission lines and road transportation. The corridor then parallels within the Piceance Creek corridor until it reaches the Piceance Creek South corridor where it separates and heads east to southeast through Deer Creek to Rio Blanco and the Rifle-Meeker corridor.

Land Title Transfers

The Bureau would process, initiate and favor actions for the consolidation of public land where overall land management would be improved. Emphasis would be directed toward the identification of nonenergy mineral lands for sale, acquisition, and Recreation and Public Purposes (R&PP) actions. These actions would involve lands that have little or no wildlife habitat value or limited management opportunities due to tract size and access difficulties.

Sales

Sales would be considered as needed for public land administration, private land needs and industrial development. Nearly 850 acres have been identified for potential sale as shown in Figure III-13. Other lands would be considered for sale if they meet any or all of the following disposal criteria:

1) Lands that meet any or all of the three criteria specified in the Federal Regulations 43 CFR, Part 2710.0-3;

2) Lands within a three mile radius of the corporate boundaries of the towns of Meeker and Rangely for community expansion;

3) Scattered non-urban tracts which make efficient management impractical;

4) Lands designated for agricultural, commercial or industrial developments as their most appropriate use;

5) Actions which will not conflict with existing law, regulatory or statutory authorities;

6) Lands adjoining other Federal, State or local government lands that could be better managed by those entities;

7) Lands not specific to critical resource concerns; or

8) Mineral estates without economic mineral value and where Federal mineral ownership would interfere with surface estate development and where development would be more beneficial than the mineral estate development.

Acquisition

The Bureau would process, initiate and favor actions for the consolidation and easement to public land where overall land management would be improved. Emphasis would be placed on aquisition of those lands that improve access to public lands. No acreage limitations would be placed on such actions. Lands or interests to lands considered for acquisition would include:

1) Lands adjacent and controlling access to intensively managed tracts of public land where overall program management would be enhanced, such as lands adjacent to intensively managed hunting areas, grazing allotments or important wildlife areas.

2) Private or state land within large blocks of public lands.

Exchanges

Land exchanges on lands not having oil shale mineral reservations would be evaluated for land values, renewable resource values, and/or other mineral values. Land exchanges containing oil shale or oil shale and associated mineral values would be based on a determination of equal value for both offered and selected lands. The equal value is based on either: 1) a simple recoverable ton for ton or recoverable synthetic crude barrel for barrel, or 2) an adjusted resource for resource equivalent based on the criteria established in 43 CFR 2201.3(c).

Recreation and Public Purposes

Public land potentially suitable for development within a three mile radius of the corporate boundaries of the towns of Meeker and Rangely would be identified for community expansion through Recreation and Public Purpose (R&PP) actions. These lands would be available for sale or lease to meet the land demand for uses that benefit the public at large. Lands that are specific to critical resources such as wildlife, threatened or endangered species habitat, fragile soils, steep slopes and sensitive watersheds would not be available for community expansion. Lands with existing Federal energy and mineral leases would remain open to community expansion provided that the uses are compatible. Should a conflict occur between community expansion and development of Federal energy and mineral leases, the energy and mineral development will have priority over community expansion. All Recreation and Public Purpose actions would be restricted as necessary to protect other resources on a case-by-case basis. R&PP sales would recognize the prior rights of Federal energy and mineral lease holders. Lands considered suitable for title transfer by Recreation and Public Purpose action would need to meet the requirements of Federal regulations and the following criteria:

1) Lands proximate to cities, towns or development areas;

2) Lands designated for commercial or industrial development as the highest value or otherwise most appropriate use; or

3) Actions which would not conflict with existing law, regulatory or statutory authorities.

FIRE MANAGEMENT

Under this alternative, the management objective would be to prepare and implement a Fire Management Plan. This plan would provide the guidance required for proper management of wildfires in the study area. It would permit the option of immediate suppression in areas requiring protection from wildfire or allow fires to burn naturally in areas where desired resource benefits would occur. Wildfire control measures would be developed and recommended for implementation in each fire management area.

Prescribed burn policies and planned accomplishments would be implemented as identified in the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980) and as identified in the Bureau's Air Quality Maintenance requirements, described in the Current Management Alternative.

SPECIAL MANAGEMENT AREAS

Twelve Special Management Areas would be designated totalling 23,965 acres. The proposed areas are: Deer Gulch, Dudley Bluffs, King Gulch, Lower Greasewood Creek, Lower Hay Gulch, North Cathedral Bluffs, School Gulch, Soldier Creek, South Cathedral Bluffs, Spring Gulch, Upper Greasewood Creek and Yanks Gulch. The designation type, acreage, significant elements, management objectives and management constraints are described in detail in Appendix B. Studies would be conducted to monitor conditions and trend in these areas.

OIL AND GAS ALTERNATIVE

This alternative places management emphasis on planning and providing for oil and gas development and transportation. It also places management priority on providing access to the public lands for other resource values including forest products, off-road vehicle use and major linear rights-of-way. Management actions would be taken to assure access to the public lands for a wide variety of uses.

AIR RESOURCE MANAGEMENT

Basic management activities as described in the Current Management Alternative would continue including monitoring, analysis, permit compliance, impact mitigation and management of the resource for minimal impact.

MINERAL ACTIVITY

Leasable Minerals

Oil Shale

In this alternative, oil shale development would be concentrated in the open pit area on the western side of the planning area, and in the southern portion of the basin where underground mining methods would be used. The richest part of the oil shale deposits in the center of the basin would be reserved until technology has proven improved recovery rates for oil shale and associated minerals. Oil shale lands would also not be offered for lease in the Piceance Dome area east of Piceance Creek because of the rich oil and gas deposits in the area.

Prototype Tract C-a's proposal to continue their active mine face to the south and east of that tract in a migrating open pit could be accommodated by future leases adjacent to that tract. The value of the pit and the active mine face could be transferred to future lessees of adjacent tracts through negotiation mediated by the Bureau of Land Management. Those leases would utilize the developed pit on C-a for backfill and continue the migrating pit to the southeast.

Additional open pit oil shale leases could be accommodated in the open pit zone where it is compatible with the management priority. However, careful consideration must be given to the needs for offsite disposal, conflicts with other developments (including C-a), the oil and gas resource values that may be foregone by open pit mining or offsite disposal of spent shale, and the potential inefficiences and cumulative environmental impacts of more than one migrating open pit in such close proximity. Recovery rates and mining success of the first stages of Tract C-a's open pit development should be evaluated prior to offering additional open pit leases.

Oil shale leases for underground mining techniques would be permitted within the underground oil shale management priority area. The location and configuration of any future leases would be determined by the results of formal expressions of interest from industry. Mining techniques could include surface mining with surface retorting, some kind of modified in-situ process, or true in-situ methods, depending on the geologic suitability of future lease tracts. The area available for future oil shale leasing under this alternative is shown in Figure III-16.

Future lease offerings would be scheduled as demand for oil shale develops. Based on public input and the recommendations of the Regional Oil Shale Team, BLM would seek industry expressions of interest within the area shown in Figure III-16, delineate mineable tracts, and analyze the potential social, economic and environmental impacts on a site-specific basis. Included in the evaluation of the need for additional leasing would be consideration of the progress and success of existing federal leases. If it is determined that existing leases are proving commercially successful, a sequential lease-offering process shall be followed whereby an attempt would be made to avoid the overlap of construction phases for more than two tracts. This translates into leasing no more than two tracts every five years only as long as existing leases progress successfully. Oil shale land exchanges would be considered as proposed by private industry through expressions of interest, giving full consideration to the potential problems that would be encountered by federal oil and gas lessees on the exchanged lands. Private oil shale development on exchanged lands would be counted against the lease limit of no more than two tracts every five years.

Research tracts would be considered by BLM on the merits of the technology proposed by the applicant. Consideration of such research leases would include a determination of the appropriateness of the oil shale resource for the technology-testing that is proposed, the potential environmental and socioeconomic impacts of such a lease and a determination of whether the lease is in the public interest. No commercial-scale operations would be



LANDS AVAILABLE FOR OIL SHALE LEASING
OIL AND GAS ALTERNATIVE

Figure III-16

considered under this provision. While tract size is not specified, it is anticipated that research leases would not exceed 2,000 acres. Research tracts for technology-testing would not be counted against the lease limit of no more than two tracts every five years.

Offsite leases for spent shale disposal would be considered within the limits and constraints of existing laws and regulations, giving careful consideration to the oil and gas minerals that may be foregone, the potential environmental impacts of such a lease, and whether such a lease would be in the public interest.

Sodium

All public lands in the planning area would be excluded from further sodium mineral leasing until the existing sodium leases and any sodium Preference Right Lease Applications that are leased are developed or a proven demand arises. Site-specific leasing restrictions to protect other resources would be imposed prior to leasing or exploration where another resource was shown as having priority. Standard lease stipulations would apply as referenced in the leases.

Coal

All Federal lands with potential for coal development and acceptable for underground coal mining, approximately 29,610 acres identified in the *Coal Amendment to the White River Resource Area Land Use Plan* (USDI, BLM December 1981b) would be favored for future leasing. Site-specific restrictions may be imposed to protect other critical resource values. Restrictions would become part of the lease on approved mine plans.

Development and exploration of new and existing oil and gas mineral leases would have priority over coal lease development within the coal priority area. Oil and gas development and exploration within the coal priority area would be evaluated on a case-by-case basis. Future coal leasing within the coal priority area would provide for the future extraction of the oil and gas minerals through stipulations in the coal lease.

Oil and Gas

All public lands in the planning area would continue to remain open to oil and gas leasing. Known Geologic Structures, designated Tight Gas Formations and a two mile wide zone surrounding these areas having the greatest potential for development would be committed to the exploration and development of oil and gas resources. Standard oil and gas lease stipulations would be applied to the area. Future oil shale leases within the management priority area for oil and gas must provide for the development of oil and gas prior to or concurrently with oil shale development through stipulations in the oil shale lease. In addition, the site-specific or temporary restrictions specified in the *White River Resource Area Oil and Gas Umbrella Environmental Assessment* (USDI, BLM February 1982) would be imposed prior to leasing or exploration to protect other important resources, and to plan for orderly development of the resource.

Locatable Minerals

All public lands in the planning area would remain open to entry for exploration, location and development of locatable minerals under the provisions of the General Mining Law of 1872 as amended, except those lands under protective withdrawal that would be excluded from mineral entry. Development and certain types of exploration could have site-specific or temporary restrictions imposed to protect other important resource values.

Saleable Minerals

The public lands would be available to provide mineral materials to meet the demands not filled by private enterprise and would provide free materials to local, state and Federal agencies for road maintenance and construction. Existing or previously used sites would be favored. An inventory of mineral materials would be conducted to find new sites to meet the demand. Sand and gravel development would be excluded in areas of mandatory protection. Site-specific restrictions would be required to protect other resource values.

WATER RESOURCES

Upon completion of the 1984-1985 stream channel stability inventories (see Current Management Alternative), all streams on public lands in the planning area that meet or exceed State water quality standards and have acceptable channel stability would be maintained in their present condition through limited management. Limited management practices that would be employed are as follows:

1. Exclude surface disturbing activities from sensitive watersheds, where resulting erosion would degrade water quality.

2. Provide buffer strips between streams and surface disturbing activities such as mining, road building, clearcutting trees, etc.

3. Ensure rapid revegetation of disturbed areas.

4. Control erosion or runoff from disturbed sites.

5. Limit vegetation manipulations or treatments of sensitive watersheds to spraying, aerial seeding or designed grazing systems.

6. Place time restrictions on surface disturbing activities to avoid the spring thaw and runoff seasons.

7. Apply recommendations made in the Northwest 208 Plan to Bureau water quality control and improvement projects, if feasible. Ensure that the best management practices available are incorporated.

Streams not meeting state standards would be improved by application of these management practices to meet the minimum standards, provided they meet the following criteria for intensive management:

1. Twenty percent or more of the watershed is in a moderate to severe erosion class (sensitive watersheds).

2. The land pattern is such that watershed improvement projects initiated by BLM would have a noticeable improvement on water quality.

3. The pollution source is on public land.

4. Fish and wildlife would benefit from channel stability.

Groundwater would be protected to maintain present quality. This would be achieved by placing restrictions on activities that may affect subterranean water. Degradation by toxins and other impurities would be regulated by present management practices, additional stipulations would be placed on groundwater usage and disposal on a case-by-case basis.

Sensitive watersheds would be identified through watershed management plans and protected by placing restrictions on activities that may adversely affect them. Improvements to sensitive watersheds would be accomplished through intensive management practices initiated by other resource programs.

SOILS

The objectives of the soil program would be to impede deterioration of soil conditions and to stabilize and rehabilitate areas where accelerated erosion and runoff have resulted in unacceptable resource conditions. During project planning, detailed soil maps would be analyzed to determine soil productivity potential and engineering suitability. This would be followed with onsite soil investigations to make site-specific recommendations on project locations.

Management necessary to achieve the soil program objectives would include the following practices:

- Avoid development on areas with high wind and water erosion susceptibility, saline soils and especially steep clayey slopes.

- Application of site-specific reclamation stipulations to maintain soil productivity and stability on disturbed sites.

- Seasonal road closures during periods of water saturated soil conditions (when top soil is saturated to a depth of 3 inches).

- Develop and implement watershed activity plans to stabilize sensitive watersheds and monitor soil erosion losses on selected areas.

FORESTRY

The management objective would be to increase annual commercial sale volumes to the maximum level acceptable under sustained yield principles. This is based on the projected increase in public demand for forest products. This would include the layout and commercial sale of an estimated 4,000 cords of pinyon-juniper firewood and 300,000 board feet of Douglas fir sawtimber on an annual basis. Additional product sales to individuals would be handled on a case-by-case basis.

A comprehensive forest management plan would be developed to identify actions necessary to achieve this objective. Compliance checks would be required on all existing and proposed timber sales.

Energy development would be managed to minimize the need for clearing of forested areas. Stipulations for timber disposal and rehabilitation of project sites would be included on each action. Developers would purchase all timber products that would be destroyed prior to project commencement. Newly developed roads resulting from energy

development would be used for access to forest product sales.

LIVESTOCK GRAZING

Forage allocation to livestock would be increased from the current maximum authorized use of 57,016 AUMs to 63,724 AUMs over the long-term.

Allotment Management Plans (AMPs) would be developed for each allotment in the study area. Two categories of AMPs are proposed: intensive and less intensive.

Five allotments are presently under intensive management with developed AMPs and would continue to be managed this way: Dry Fork, Segar Gulch, Piceance Mountain, Reagles and Square S. Intensive management and development of AMPs would be initiated on 24 additional allotments. Grazing systems and specific range improvements would be identified as AMPs are developed. Allotment Management Plans would be designed to coordinate livestock grazing with other land uses to meet multiple use objectives. Intensive monitoring and study programs would be conducted on each allotment proposed for intensive management.

Less intensive management is proposed for Lower Fourteen Mile, Puckett Gulch and Pine Knott Gulch, Powerline and Skinner Ridge allotments. These allotments involve small acreages of public land making it impractical or uneconomical to administer the intensive management practices identified above.

Implementation of AMPs was originally scheduled for completion by 1988 in the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980). However, based on present funding levels full implementation may not be achieved until the year 2000.

The White River Trail would continue to be available for livestock trailing. Mitigation of impacts from energy development would be required.

WILD HORSES

Wild horses would be managed to maintain a herd population of 65-100 by 1988. This would require a forage allocation of between 1,040-1,600 AUMs. Since an estimated 159 wild horses currently reside in the study area, removal operations would be required to reduce populations to desired levels. Follow-up horse removal operations would be necessary to maintain populations within this level. Projects would be implemented to provide forage and water to sustain this herd.

WILDLIFE

All wildlife habitat would be managed with emphasis directed to crucial habitats of threatened and endangered species, raptors, mule deer, elk and sage grouse, fish, and selected non-game species. The Piceance Basin Habitat Management Plan would be implemented as funding permits.

Initial forage allocation to wildlife would be 36,253 AUMs. This level of allocation would sustain short-term BLM-Colorado Division of Wildlife big game population objectives for the study area. This allocation would be increased to 40,501 AUMs over a 20 year period allowing mule deer and elk populations to increase by 12 percent and 8 percent, respectively.

Wildlife habitat improvement projects would be directed to increase production and condition of big game winter forage. Off road vehicle (ORV) restrictions would be enforced during crucial time periods on essential wildlife habitat areas to minimize disturbances. Current research efforts would be continued to collect data necessary for proper management. A detailed monitoring system would be developed and implemented for species of management emphasis.

Allotment Management Plans would be designed and developed to achieve wildlife objectives identified in the *White River Resource Area Management Framework Plan* (USDI, BLM 1981). Studies and monitoring programs would be implemented to assess attainment of these objectives. All range projects and forest product sales would be implemented subject to standard operating procedures and design restrictions. Wild horse populations would be controlled on the designated Herd Management Area to minimize competition with wildlife. A Fire Management Plan would be implemented to allow beneficial effects of wildlife in designated areas. Reclamation restrictions to replace wildlife habitat would be placed on all energy development actions. Seasonal and locational restrictions would be applied only on crucial wildlife ranges. An Industrial Association would be recommended to better coordinate mitigation efforts and improve technology to reduce site-specific and cumulative impacts to the wildlife resource from energy development.

THREATENED, ENDANGERED, RARE AND SENSITIVE PLANTS AND REMNANT VEGETATION ASSOCIATIONS

Populations and habitat of rare or sensitive plants and remnant vegetation associations would be protected from activities that result in adverse impacts. Known populations in areas grazed by livestock would be monitored to determine if interresource conflicts occur. On-the-ground surveys by a qualified specialist would be required for actions in areas of known or potential habitat on public land prior to any surface disturbing activity. See Appendix B, Special Management Areas for more detail on management of these resources in this alternative.

CULTURAL RESOURCES

Management of cultural resources in the planning area would be directly related to the surface disturbing activities administered by other programs. The cultural resource program in the White River Resource Area would be a support activity. Most Class III inventory in the Piceance Basin was conducted by energy companies in compliance with grant or lease stipulations issued by the BLM. More effective management is achieved through inventory of large blocks of land rather than a piecemeal or a project-by-project strategy.

Standard stipulations for protecting cultural resources on public land that are currently in effect would remain the standard operating procedure. These stipulations have standardized the requirements for adequate cultural resource inventories prior to surface disturbance. They also state the procedure to be followed in the event that cultural resources are discovered during the construction phase of a project and regulate requirements for monitors when they are required in specific cases. Existing BLM Colorado State policy specifies the extent and instances where Class III inventory is required. These differ according to type of project proposed.

PALEONTOLOGICAL RESOURCES

Paleontological resources would be managed according to the classification scheme described in the Current Management Alternative. This program would include future inventory, analysis, permitting, impact mitigation and management of the resource for commercial and recreational collecting.

RECREATION

The major emphasis on recreation management in the Piceance Basin would remain on hunting use. Most of the planning area would be managed as an Extensive Recreation Management Area (ERMA), with a 5,000 acre area of high hunting use designated as a Special Recreation Management Area (SRMA). This would be located within the southeast unit of the SRMA as proposed in the Wildlife Alternative, Figure III-15. A hunter information trailer would be located at the White River Resource Area office during hunting season. Trash collection would be undertaken at critical locations in the basin during that time. Signs would be installed and replaced as necessary. Fire crews would be utilized to clean camp sites and roadside areas on an as-needed basis.

Off-road vehicle (ORV) use in the Piceance Basin would be managed primarily under the "open" classification. A Non-motorized Hunting Area, which would seasonally restrict motorized vehicle use on approximately 5,000 acres during the big game hunting season, would be established within the SRMA. A Recreation Area Management Plan would be prepared in order to define the area and establish specific recreation management objectives and actions. ORV restrictions would be implemented seasonally on saturated roads and permanently on three Special Management Areas totalling 5,500 acres (see Appendix C). With the exception of the Non-motorized Hunting Area, recreation management objectives would be to maintain the semi-primitive motorized and roaded natural Recreation Opportunity Spectrum (ROS) settings in hunting concentration areas. This alternative would result in a more diversified recreation opportunity spectrum by creating a 5,000 acre semi-primitive non-motorized area and several areas with travel restricted to existing roads and trails. The objectives of the Colorado State Comprehensive Outdoor Recreation Plan would be met.

VISUAL RESOURCES

Visual resource management (VRM) would remain a support activity for other resource programs and subactivities. Visual design would be emphasized as a means to reduce the contrast of projects with moderate to high impacts or projects which are proposed in sensitive areas.

The contrast rating system, as described in the revised BLM policy guidelines for VRM (IM No. CO-83-234), would be implemented. It is the responsibility of the program which is initiating development activity, to ensure that visual values are adequately maintained.

TRANSPORTATION

Existing transportation systems are adequate at the present level of demand for development of energy resources.

Because of the extensive network of roads resulting from development of oil and gas resources, access is adequate for other users of the public lands, particularly for hunters, wood cutters and ranchers.

Criteria for transportation management are outlined in the following documents:

- BLM Manual Sec. 9112 (Bridges and Culverts) and Sec. 9113 (Roads);
- Craig District Transportation Plan;
- White River Resource Area Oil and Gas Umbrella Environmental Assessment;
- Surface Operating Standards for Oil and Gas Development; and
- Site-specific stipulations developed through right-of-way applications, Applications for Permit to Drill (APDs), and mining plans.

Management of the transportation network would be in response to the proposal of individual projects. Use of corridors for rights-of-way, as identified in the Management Framework Plan, would continue to be encouraged but would not be officially designated. Five Year Plans of Development would continue to be requested from industry on a voluntary basis. Because oil and gas roads are considered temporary, the Craig District Transportation Plan would have to be updated periodically in order to assure continued access for other (nonenergy) uses of the resource area.

LANDS AND REALTY

Use Authorizations

Applications for use authorizations would be processed and approved on a case-by-case basis giving priority to those actions that are related to intensive oil shale and oil and gas mineral development. Location and routes would be situated in an economically and environmentally sound manner emphasizing development on existing disturbed lands. Use authorizations include temporary use permits, rights-of-way, permits, leases, reservoir sites, easements and communication sites. Use authorization actions could include access roads, pipelines, powerlines, utilities and railroads and must meet the following criteria:

1) Applications must meet the requirements of existing law and Bureau policy.

2) Placement on or use of public lands must not be in conflict with lands specific to critical resource needs. Emphasis will be on mitigation of the resource values where possible to accommodate the proposed use.

3) Application should support private or governmental needs on a local or regional basis.

Applications for use authorizations would be processed and approved if they do not conflict with the development or transportation of important energy or mineral resources. Potential reservoir sites would be evaluated and remain free of encumbrances until a definite decision is implemented.

Placement of major linear rights-of-way such as highways, pipelines and transmission lines would be encouraged within or contiguous to existing major rights-of-way that would best meet the needs of efficient development and transportation of energy and mineral resources. Steep topography, poor soils, high visual sensitivity, known rare and sensitive plant locations, threatened and endangered species habitats, cultural sites and other fragile areas would be avoided. Recommended areas for locating these rights-of-way are shown on the Oil and Gas Alternative map (see Map Addendum).

Applicants would be encouraged to locate facilities within areas that meet the above criteria. Corridors will not be designated in this alternative.

Land Title Transfers

The Bureau would process, initiate and favor actions for the consolidation of public land where overall land management would be improved. Emphasis would be directed toward publicly offering nonenergy mineral lands through sale, acquisition and Recreation and Public Purposes actions. These actions would involve lands that meet the need for community expansion, and accommodate facilities to support the development of oil and gas minerals.

Sales

Sales would be considered as needed for public land administration, private land needs, industrial development and community expansion. Nearly 850 acres have been identified for potential sale, however, no acreage limitations would be placed on such actions. Further identification of lands suitable for title transfer by sale would include those lands identified by and or all of the criteria in the Wildlife Alternative and any or all of the following criteria:

1) Lands surrounded by and/or contiguous to private lands that could enhance the operation and/or use of those lands.

2) Lands within a five mile radius of Meeker and Rangely would be potentially suitable for community expansion.

Acquisition

The Bureau would process, initiate and favor actions for consolidation and easement to public land where overall land management would be improved. Emphasis would be placed on aquisition of those lands that improve access to public lands. No acreage limitations would be placed on such actions. Lands or interests to lands considered for acquisition would include:

1) Lands adjacent and controlling access to intensively managed tracts of public land where overall program management would be enhanced, such as lands adjacent to intensively managed hunting areas, grazing allotments or important mineral areas.

2) Private or state land within large blocks of public lands, that control access to Federal lands.

3) Lands of mineral importance where the Federal minerals are overlain by State or private surface ownerships.

Exchanges

Land exchanges on lands not having oil shale mineral reservations would be evaluated for land values, renewable resource values, and/or other mineral values. Land exchanges containing oil shale or oil shale and associated mineral values will be based on a determination of equal value for both offered and selected lands. The equal value is based on either: 1) a simple recoverable ton for ton or recoverable synthetic crude barrel for barrel, or 2) an adjusted resource equivalent for resource equivalent based on the criteria established in 43 CFR 2201.3(c).

Recreation and Public Purposes

The Recreation and Public Purposes Act (R&PP) allows for the sale or lease of lands to existing communities to meet their needs for uses that benefit the public at large. Public land potentially suitable for development within a five mile radius of the corporate boundaries of the towns of Meeker and Rangely would be identified for community expansion and use. Lands that are specific to critical resources such as wildlife, threatened and endangered species habitat, fragile soils, steep slopes and sensitive watersheds would not be available for community expansion. Lands with existing Federal energy and mineral leases will remain open to community expansion provided the uses are compatible. Should a conflict occur between community expansion and development of the Federal energy and mineral leases, the energy and mineral development will have priority over community expansion. All Recreation and Public Purpose (R&PP) actions will be restricted as necessary to protect other resources on a case-by-case basis. R&PP sales will recognize the prior rights of Federal energy and mineral lease holders.

FIRE MANAGEMENT

Under this alternative, the management objective would be to prepare and implement a Fire Management Plan. This plan would provide the guidance required for proper management of wildfires in the planning area. It would permit the option of immediate suppression in areas requiring protection from wildfire or allow fires to burn naturally in areas where desired resource benefits would occur. Wildfire control measures would be developed and recommended for implementation in each fire management area.

Prescribed burn policies and planned accomplishments would be implemented as identified in the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980) and as identified in the Bureau's Air Quality Maintenance requirements, described in the Current Management Alternative.

SPECIAL MANAGEMENT AREAS

Three Special Management Areas would be designated for a total of 5,745 acres. The proposed areas are: Deer Gulch, Dudley Bluffs and South Cathedral Bluffs. The designation type, acreage, sig-

nificant elements, management objectives and management constraints are described in detail in Appendix B.

OIL SHALE ALTERNATIVE

Management emphasis in this alternative would be placed on the development, production and transportation of oil shale and associated minerals on the public lands in the planning area. Priority is placed on making lands available for commercial oil shale leasing by private industry as demand and economics dictate.

AIR RESOURCE MANAGEMENT

Basic management activities as described in the Current Management Alternative would continue including monitoring, analysis, permit compliance and impact mitigation, but with the maximum allowable impacts. Due to the expanded development levels under this alternative, all aspects of air resource management would be intensified.

MINERAL ACTIVITY

Leasable Minerals

Oil Shale

Oil shale would have priority over management of other resource values in this alternative. Future leasing would make available lands suitable for different methods of oil shale development. Leasing of lands in the management priority area for multimineral development would require the extraction of sodium minerals concurrently or sequentially with the oil shale.

Leasing in the open pit oil shale management priority area should consider the potential of open pit mining. If underground methods are preferred, the effect on existing open pit leases and potential oil shale resources that may be foregone shall be assessed. Open pit mining would not be permitted outside the open pit management priority area.

Prototype Tract C-a's proposal to continue their active mine face to the south and east of that tract in a migrating open pit could be accommodated by future leases adjacent to that tract. The value of the pit and the active mine face could be transferred to future lessees of adjacent tracts through negotiation mediated by the Bureau of Land Management. Those leases would utilize the developed pit on C-a for backfill and continue the migrating pit to the southeast.

Additional open pit oil shale leases could be accommodated in the open pit zone where it is compatible with the management priority. However, careful consideration must be given to the needs for offsite disposal, conflicts with other developments (including C-a), and the potential cumulative environmental impacts of more than one migrating open pit in such close proximity. Recovery rates and mining success of the first stages of Tract C-a's open pit development should be evaluated prior to offering additional open pit leases.

Oil shale leases for underground mining techniques would be permitted within the underground oil shale management priority area. The location and configuration of any future leases would be determined by the results of formal expressions of interest from industry. Mining techniques could include underground mining with surface retorting, some kind of modified in-situ process, or true in-situ methods, depending on the geologic suitability of future lease tracts.

Lease offerings would begin by 1986 and be considered at least every five years. The number of tracts to be leased, their location and configuration would be determined by BLM based on expressions of interest from industry, Regional Oil Shale Team recommendations and input from the public. Lease tract locations spread evenly throughout the oil shale management priority area would be encouraged in order to disperse impacts from development. The only exception to this would be in the open pit zone where leases adjacent to Tract C-a would be encouraged to continue their migrating pit. The lands available for oil shale leasing in this alternative are shown in Figure III-17.

Oil shale land exchanges would be considered as proposed by private industry through expressions of interest, and as initiated by BLM to consolidate Federal land ownership to facilitate Federal oil shale leasing.

Research tracts would be considered by BLM on the merits of the technology proposed by the applicant. Consideration of such research leases would include a determination of the appropriateness of the oil shale resource for the technology-testing that is proposed, the potential environmental and socioeconomic impacts of such a lease and a determination of whether the lease is in the public interest. No commercial-scale operations would be considered under this provision. While tract size is not specified, it is anticipated that research leases would not exceed 2,000 acres.



LANDS AVAILABLE FOR OIL SHALE LEASING
OIL SHALE ALTERNATIVE

Figure III-17

Offsite leases for spent shale disposal would be considered within the limits of existing laws and regulations. Special consideration would be given to evaluating the oil shale resources that may be foregone due to disposal.

Sodium

All public lands within the multimineral management priority area would remain open to sodium mineral (nahcolite and dawsonite) leasing only in conjunction with oil shale multimineral leasing. No new sodium-only leasing would occur. Existing areas having the greatest sodium mineral potential for development in conjunction with the oil shale deposits would be committed to the exploration and development of these resources concurrently. Standard lease stipulations as referenced in the Federal Oil Shale Management Program would apply to these areas. Site-specific leasing restrictions would be imposed prior to leasing or exploration where another resource was shown as having priority.

Coal

All Federal lands with coal development potential and identified as acceptable for coal development in the *Coal Amendment to the White River Resource Area Land Use Plan* (USDI, BLM December 1981b) would be open to leasing. Both surface and underground mining would be considered where acceptable; 29,610 acres acceptable for underground mining; of the 29,610 acres, 24,635 acres are also acceptable for surface mining (see Figure III-5). In areas where sufficient interburden exists, both surface and underground mining would be favored for leasing. Those lands identified as priority areas for oil shale development and identified as unacceptable for surface mining would be excluded from future coal leasing consideration. Site-specific restrictions may be imposed to protect other critical resource values. Restrictions would become part of the lease and approved mine plans.

Oil and Gas

All public lands in the planning area would continue to remain open to oil and gas leasing. Known Geologic Structures and designated Tight Gas Formations which have the greatest potential for development would be committed to the exploration and development of oil and gas resources. Standard oil and gas lease stipulations would apply and include a stipulation protecting and giving priority to the development of oil shale resources in these areas. In addition, site-specific or temporary restrictions specified in the *White River Resource Area Oil and Gas Leasing Umbrella Environmental Assessment* would be imposed prior to leasing or exploration to protect other important resources, and to plan for a more orderly development of the oil and gas resource.

Locatable Minerals

All public lands in the planning area would remain open to entry for exploration, location and development of locatable minerals under the provisions of the General Mining Law of 1872 as amended, except those lands under protective withdrawal that would be excluded from mineral entry. Development and certain types of exploration could have site-specific or temporary restrictions imposed to protect other important resource values.

Saleable Minerals

All public lands would provide mineral materials to meet the demands not filled by private enterprise and would provide free materials to local, state, and Federal agencies for road maintenance and construction. Existing or previously used sites would be favored. An inventory of mineral materials would be conducted to find new sites to meet the demand. Sand and gravel development would be excluded in areas of mandatory protection. Site-specific restrictions would be required to protect other resource values.

WATER RESOURCES

Upon completion of the 1984-1985 stream channel stability inventories, all streams on public lands in the planning area that meet or exceed State water quality standards and have acceptable channel stability would be maintained in their present condition through limited management. Limited management practices that would be employed are as follows:

1. Exclude surface disturbing activities from sensitive watersheds, where resulting erosion would degrade water quality.

2. Provide buffer strips between streams and surface disturbing activities such as mining, road building, clearcutting trees, etc.

3. Ensure rapid revegetation of disturbed areas.

4. Control erosion or runoff from disturbed sites.

5. Limit vegetation manipulations or treatments of sensitive watersheds to spraying, aerial seeding or designed grazing systems.

6. Place time restrictions on surface disturbing activities to avoid the spring thaw and runoff seasons.

7. Apply recommendations made in the Northwest 208 Plan to Bureau water quality control and improvement projects, if feasible. Ensure that the best management practices available are incorporated.

Streams not meeting State standards would be improved by application of these management practices to meet the minimum standards, provided they meet the following criteria for intensive management:

1. Twenty percent or more of the watershed is in a moderate to severe erosion class (sensitive watersheds).

2. The land pattern is such that watershed improvement projects initiated by BLM would have a noticeable improvement on water quality.

3. The pollution source is on public land.

4. Fish and wildlife would benefit from channel stability.

Groundwater would be protected to maintain present quality. This would be achieved by placing restrictions on activities that may affect subterranean water. Degradation by toxins and other impurities would be regulated by present management practices, additional stipulations would be placed on groundwater usage and disposal on a case-by-case basis.

Sensitive watersheds would be identified through watershed management plans and protected by placing restrictions on activities that may adversely affect them. Improvements to sensitive watersheds would be accomplished through intensive management practices initiated by other resource programs.

SOILS

Management objectives would be directed toward maintaining present soil resource conditions. Standard stipulations would be applied on all surface disturbing activities. Only minimal additional restrictions would be enforced on activities occurring on fragile or productive soils. Watershed management plans would be developed to identify sensitive watersheds. Input to BLM initiated projects and road maintenance would be minimal.

FORESTRY

Annual advertised sales would be reduced to approximately 1,000 cords of non-regulated pinyon-juniper firewood and 100,000 board feet of Douglas fir sawtimber (regulated). Forest product sales to individuals would not be reduced and would be handled on a case-by-case basis. Compliance would be performed only on existing sales. A Forest Management Plan would not be developed.

When energy development actions impact forested areas, developers would be required to purchase all timber products prior to project commencement. Stipulations for timber disposal and rehabilitation of disturbed sites would be included on each development action.

LIVESTOCK GRAZING

Livestock grazing use in the study area would be reduced from the current maximum authorized use of 57,016 Animal Unit Months (AUMs). Use adjustments would occur primarily on those allotments where oil shale development occurs until forage lost to disturbance is replaced.

Five allotments are presently under intensive management with developed Allotment Management Plans (AMPs) and would continue to be managed this way: Dry Fork, Segar Gulch, Piceance Mountain, Reagles and Square S. Intensive management and development of AMPs would be initiated on 24 additional allotments. Grazing systems and specific range improvements would be initiated as AMPs are developed. Allotment Management Plans would be designed to coordinate livestock grazing with other land uses to meet multiple use objectives. Intensive monitoring and study programs would be conducted on each allotment proposed for intensive management.

Less intensive management is proposed for Lower Fourteen Mile, Puckett Gulch and Pine Knott Gulch, Powerline and Skinner Ridge allotments. These allotments involve small acreages of public land making it impractical or uneconomical to administer intensive management practices.

BLM funded range projects would not be implemented in areas of existing or proposed oil shale development. The White River Trail would continue to be available for livestock trailing.

WILD HORSES

Public lands would be managed for a maximum of 65 horses in the planning area. Initially, 94 horses would be removed to achieve this population objective. This would be followed by periodic removals to maintain the herd size. Periodic surveys would be needed to monitor herd increases. All horses outside the designated Herd Management Area would be permanently removed. A forage allocation of 1,040 AUMs would be required to support this herd.

Impacts associated with oil shale leasing and development would have to be reconciled with maintenance of a viable wild horse herd within the Herd Management Area.

WILDLIFE

Only crucial habitats of threatened and endangered species, raptors, mule deer and elk would be managed at minimal levels. The Piceance Basin Habitat Management Plan would be implemented but may be revised to accommodate oil shale development objectives.

Both initial and long-term forage allocation to wildlife would be 36,353 AUMs. This level of allocation would sustain only 80-85 percent of the BLM and Colorado Division of Wildlife population objectives for mule deer and elk in the planning area. Wildlife projects would be implemented only in critical situations. Existing wildlife projects would be maintained. Research and field data would be collected only when needed for site-specific project analysis.

Wildlife objectives would be incorporated into Allotment Management Plans when they are developed. A wildlife habitat monitoring system would be developed and implemented for crucial big game ranges in areas of implemented AMPs. Only limited monitoring would be performed on allotments of less intensive management.

Reclamation, seasonal and locational restrictions would be enforced on energy development actions on crucial habitats for threatened and endangered species, raptors, mule deer and elk. An Industrial Association would be encouraged to better coordinate mitigation efforts and improve technology to reduce site-specific and cumulative impacts to the wildlife resource from energy development.

THREATENED, ENDANGERED, RARE AND SENSITIVE PLANTS AND REMNANT VEGETATION ASSOCIATIONS

Surface disturbing activities, where possible, would avoid known locations of rare and sensitive plant species or remnant vegetation associations.

CULTURAL RESOURCES

Management of cultural resources in the planning area would be directly related to the surface disturbing activities administered by other programs. The cultural resource program in the White River Resource Area would be a support activity. Most Class III inventory in the Piceance Basin was conducted by energy companies in compliance with grant or lease stipulations issued by the BLM. More effective management is achieved through inventory of large blocks of area rather than a piecemeal or project-by-project strategy.

Standard stipulations for protecting cultural resources on public land that are currently in effect would remain the standard operating procedure. These stipulations have standardized the requirements for adequate cultural resource inventories prior to surface disturbance. They also state the procedure to be followed in the event that cultural resources are discovered during the construction phase of a project and regulate requirements for monitors when they are required in specific cases. Existing BLM Colorado State policy specifies the extent and instances where Class III inventory is required. These differ according to type of project proposed.

PALEONTOLOGICAL RESOURCES

Paleontological resources would be managed according to the classification scheme described in the Current Management Alternative. This program would include future inventory, analysis, permitting, impact mitigation and management of the resource for commercial and recreational collecting.

RECREATION

The objectives under this alternative include intensive management, where user areas and services would provide for the health, safety and con-

venience of the public, protection of the resource and accommodation of a population influx caused by oil shale development. Hunting concentration areas and areas of access to the White River would be proposed as a Special Recreation Management Area (SRMA). The rest of the planning area would be managed as an Extensive Recreation Management Area (ERMA). Recreation sites in the SRMA (including campsites, parking, access, etc.) would be developed as use and need increases. Emphasis would be on protecting and upgrading of the the resource base through visitor control and site design. Existing hunter camps in all Recreation Opportunity Spectrum (ROS) classes would be signed and improved. Access and parking in high use areas would be improved. A seasonal visitor services program for hunters would be established which would include a patrol and use supervision program and roadside information stations. Public access points in the rural ROS class along the White River would be identified and developed as use increases.

Intensive management of off road vehicle (ORV) activity in the planning area would concentrate on hunting use. Restrictions would occur only where user conflicts were a continuing problem in terms of resource degradation, public safety and maintaining a quality user experience. Provisions would be made for the sudden high use which occurs in the basin during hunting season and an effort would be made to limit environmental degradation which results from increased population during these periods.

Management practices would include establishing a regional ORV play area in a rural setting, providing necessary support facilities such as camp areas, picnic and rest facilities. A Non-motorized Hunting Area (approximately 5,000 acres), which would restrict motorized vehicles during big game hunting season (approximately 3 months) would be created within the Cow Creek unit of the SRMA after further study (see Figure III-15). This would create a semi-primitive non-motorized setting. Access would be acquired to landlocked parcels of public land where open designation is desirable. An ORV/hunting map would be developed for public information.

A Recreation Area Management Plan would be developed for the SRMA subsequent to the RMP in order to establish specific criteria, designs or other guidance for implementation of proposed campsite, river access, visitor services, ORV, Non-motorized Hunting Area and public information programs.

This alternative would increase the acreage in the semi-primitive non-motorized setting, while also enhancing and developing facilities for more intensive use in all existing classes. It would help satisfy demand for a range of experiences in the planning area. Portions of the planning area would be identified and managed as an SRMA. Management objectives would be to maintain Recreation Opportunity Spectrum (ROS) classes (see Figure II-11) within the proposed SRMA. The objectives of the Colorado State Comprehensive Outdoor Recreation Plan would be met.

VISUAL RESOURCES

Visual resource management (VRM) would remain a support activity for other resource programs and subactivities. Visual design would be emphasized as a means to reduce the contrast of projects with moderate to high impacts or projects which are proposed in sensitive areas.

The contrast rating system, as described in the revised BLM policy guidelines for VRM (IM No. CO-83-234), would be implemented. It is the responsibility of the program initiating development activity, to ensure that visual values are adequately maintained.

TRANSPORTATION

In the event that the rate of energy development accelerates, increased transportation needs would require the development of new facilities. These additional needs would include pipelines, access roads, railroad facilities and transmission lines.

Criteria for transportation management are outlined in the following documents:

- BLM Manual Sec. 9112 (Bridges and Culverts) and Sec. 9113 (Roads);
- Craig District Transportation Plan;
- White River Resource Area Oil and Gas Umbrella Environmental Assessment;
- Surface Operating Standards for Oil and Gas Development; and
- Site-specific stipulations developed through right-of-way applications, APDs and mining plans.

Improvement of existing state and county (primary) roadways would be facilitated by making the public lands available for sand and gravel resources. Development of pipelines and rail facilities for large scale projects such as oil shale would be mandated in the permit process in order to mitigate impacts to existing roadways from large scale truck traffic. The use of ridesharing and commuter buses

for large projects would be encouraged through the permitting process. The construction of access roads, pipelines, transmission lines, railroad lines and other transportation needs would be facilitated during the permitting process.

Transportation needs for specific large projects would be paid for by those developers. The District Transportation Plan (secondary roadways) would be updated to plan for the needs of the Piceance Basin. Unnecessary roads would be abandoned and reclaimed. Coordination with state and county road development would be facilitated through Memoranda of Understanding. Submission of a Five Year Plan of Development for oil and gas fields would be required and made a lease stipulation in order to reduce the cumulative impacts of access roads and pipelines.

LANDS AND REALTY

Use Authorizations

Applications for use authorizations would be processed and approved on a case-by-case basis giving priority to those actions that are related to intensive oil shale and oil and gas development. Location and routes would be situated in an economically and environmentally sound manner emphasizing further development of existing disturbed lands and designated energy corridors. Use authorizations include temporary use permits, rights-of-way, permits, leases, reservoir sites, easements and communication sites. Use authorization actions could include access roads, pipelines, powerlines, utilities, railroads, etc. and must meet the following criteria:

1) Applications must meet the requirements of existing law and Bureau policy.

2) Placement on or use of public lands must not be in conflict with lands specific to critical resource needs. Emphasis will be on mitigation of the resource values where possible to accommodate the proposed use.

3) Application supports private or governmental needs on a local or regional basis.

Applications for use authorizations would be processed and approved if they did not conflict with the development or transportation of important energy or mineral resources. Potential reservoir sites would be evaluated and remain free of encumbrances until a definite decision is implemented.

Placement of major linear rights-of-way such as highways, pipelines and transmission lines would be encouraged within or contiguous to existing facilities. These rights-of-way would be located to avoid harassment of wildlife and livestock management priority areas. Steep topography, poor soils, high visual sensitivity, known rare and sensitive plant locations or other fragile areas such as threatened or endangered species habitats and cultural sites would be avoided. These criteria would be applied to any major linear right-of-way application. Processing of major linear rights-of-way would be speeded by preliminary application of these criteria by the applicant. Corridors would not be designated in this alternative.

Land Title Transfers

The Bureau would process, initiate and favor actions for the consolidation of public land where overall land management would be improved. Emphasis would be directed toward disposal of lands through sale, Recreation and Public Purposes (R&PP) and exchange actions. These actions would involve lands that meet the needs of new and existing communities, and accommodate facilities to support the development of energy and mineral resources. Priority would be given to consideration of land exchanges for ownership consolidation for the benefit of oil shale development on both public and private lands.

Sales

Sales would be considered as needed for public land administration, private land needs, industrial development and community development. Nearly 850 acres have been identified for potential sale, however, no acreage limitations would be placed on such actions. Further identification of lands suitable for title transfer through sale would include those lands that meet any or all of the criteria identified in the Wildlife Alternative and any or all of the following criteria:

1) Lands surrounded by and/or contiguous to private lands that could enhance the operation and/or use of private lands.

2) Lands that would be necessary for large industrial facilities that are incompatible with the Bureau's programs.

3) Lands that are not necessary to support the production and transportation of energy and minerals (key access or right-of-way points).

4) Lands within a seven mile radius of the corporate boundaries of Meeker and Rangely would be potentially suitable for community expansion. Public lands potentially suitable for

development within a three mile radius of White River City and Rio Blanco would be identified for new community development, if determined necessary by local officials.

Acquisition

The Bureau would process, initiate and favor actions for consolidation and easement to public lands where overall land management would be improved. Emphasis would be placed on aquisition of those lands that improve access to public lands. No acreage limitations would be placed on such actions. Lands or interests to lands considered for acquisition would include:

1) Lands adjacent and controlling access to intensively managed tracts of public land where overall program management would be enhanced, such as lands adjacent to intensively managed hunting areas, grazing allotments or important mineral areas.

2) Private or state land within large blocks of public lands.

3) Lands of mineral importance where the Federal minerals are overlain by state or private surface ownerships.

Exchanges

Land exchanges on lands not having oil shale mineral reservations would be evaluated for land values, renewable resource values, and/or other mineral values. Land exchanges containing oil shale or oil shale and associated mineral values will be based on a determination of equal value for both offered and selected lands. The equal value is based on either: 1) a simple recoverable ton for ton or recoverable synthetic crude barrel for barrel, or 2) an adjusted resource for resource equivalent based on the criteria established in 43 CFR 2201.3(c).

Recreation and Public Purposes

The Recreation and Public Purpose Act allows for the sale or lease of lands to existing communities to meet their needs for uses that benefit the public at large. Public land potentially suitable for development within a seven mile radius of the corporate boundaries of the towns of Meeker and Rangely would be identified for community expansion. In addition, if it is determined by local officials that new community development should occur outside existing communities, lands within a three mile radius of White River City and Rio Blanco would be made available for such expansion. Lands that are specific to critical resources such as wildlife, threatened or endangered species habitat, fragile soils, steep slopes and sensitive watersheds would not be available for community expansion. Lands with existing Federal energy and mineral leases will remain open to community expansion provided the uses are compatible. Should a conflict occur between community expansion and development of the Federal energy and mineral leases, the energy and mineral development will have priority over community expansion. All Recreation and Public Purpose (R&PP) actions will be restricted as necessary to protect other resources on a case-by-case basis. R&PP sales will recognize the prior rights of Federal energy and mineral lease holders.

FIRE MANAGEMENT

Under this alternative, the object would be to prepare and implement a Fire Management Plan. This plan would provide the guidance required for proper management of wildfires in the planning area. It would permit the option of immediate suppression in areas requiring protection from wildfire or allow fires to burn naturally in areas where desired resource benefits would occur. Wildfire control measures would be developed and recommended for implementation in each fire management area.

Prescribed burn policies and planned accomplishments would be implemented as identified in the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980) and as identified in the Bureau's Air Quality Maintenance requirements, described in the Current Management Alternative.

SPECIAL MANAGEMENT AREAS

No Research Natural Areas, Outstanding Natural Areas, or Areas of Critical Environmental Concern would be designated under this alternative.

PREFERRED ALTERNATIVE

This alternative achieves the combination of management options that is the most acceptable resolution of the planning issues identified at the outset of the planning process. The alternative attempts to balance all land uses and resource values considering the impacts of all management

options and the long-term public interest and benefits of implementing the alternative.

AIR RESOURCE MANAGEMENT

Basic management activities as described in the Current Management Alternative would continue including monitoring, analysis, permit compliance, impact mitigation and management of resource for minimal impacts. Increased air resource "budgeting" would be implemented to ensure balanced utilization of multiple resources (primarily through lease tract ranking).

MINERAL ACTIVITY

Leasable Minerals

Oil Shale

In this alternative, oil shale development would be concentrated in the open pit area on the western side of the planning area, and in the southern portion of the basin where underground mining methods would be used. The richest part of the oil shale deposits in the center of the basin would be reserved until technology has proven improved recovery rates for oil shale and associated minerals. Oil shale leasing would be excluded in this zone until such technology is proven. This area, identified as the management priority area for multimineral oil shale development on the Oil Shale Alternative map in the Map Addendum, contains the thickest deposits of oil shale in the basin. Considerable rich oil shale resources would still be available outside of this zone for oil shale development. The only exceptions to this limit are Prototype Tracts C-11 and C-18 which have already been examined on a site-specific basis and are available for future leasing. These tracts and small research leases may be leased in the future under the restrictions and stipulations identified in the prototype program in an effort to prove the success of multimineral recovery technology. Lands in this area would eventually be made available for oil shale leasing once improved shale oil recovery methods have been proven, as determined by the BLM State Director. The lands that become available in the future would be subject to the same environmental and other constraints as the oil shale lands identified under this alternative. Leasing would be excluded from the Piceance Dome area east of Piceance Creek because of the rich oil and gas deposits in the area, and the unfavorable geologic setting for oil shale development.

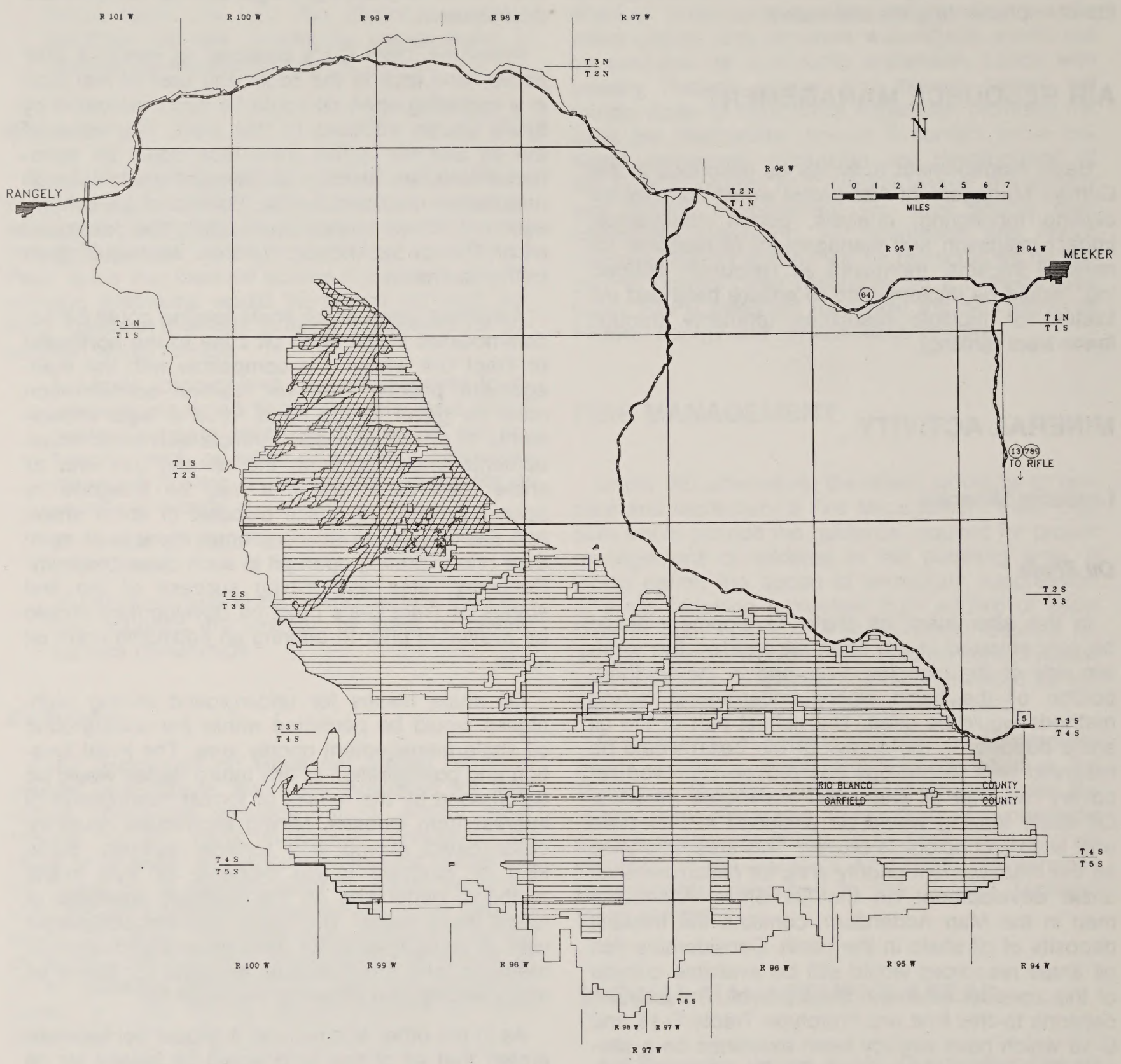
Prototype Tract C-a's proposal to continue their active mine face to the south and east of that tract in a migrating open pit could be accommodated by future leases adjacent to that tract. The value of the pit and the active mine face could be transferred to future lessees of adjacent tracts through negotiation mediated by the Bureau of Land Management. Those leases would utilize the developed pit on C-a for backfill and continue the migrating pit to the southeast.

Additional open pit oil shale leasing could be accommodated in the open pit zone to the northwest of Tract C-a where it is compatible with the management priority. However, careful consideration must be given to the need for and legal impediments to offsite disposal, conflicts with other developments (including C-a), the oil and gas and oil shale resource values that may be foregone by open pit mining or offsite disposal of spent shale, and the cumulative environmental impacts of more than one migrating open pit in such close proximity. Recovery rates and mining success of the first stages of Tract C-a's open pit development should be evaluated prior to offering an additional open pit lease.

Oil shale leases for underground mining techniques would be permitted within the underground oil shale management priority area. The initial location and configuration of any future leases would be determined by the results of formal expressions of interest from industry. Mining techniques could include direct mining with surface retorting, some kind of modified in-situ process, or true in-situ methods, depending on the geologic suitability of future lease tracts. The lands that are compatible with oil shale leasing for underground and open pit methods, and are therefore available for future oil shale leasing, are shown in Figure III-18.

As in the other alternatives, it should not be interpreted that all of this land would be leased for oil shale. Other environmental constraints would be applied at the time of tract delineation, including air pollution dispersion, critical wildlife habitat, the extent to which impacts to other resource values can be mitigated, reclamation potential, and the geologic suitability of the lands to accommodate the kind of oil shale development technology proposed by industry in their expressions of interest.

Future lease offerings would be scheduled as demand for shale oil develops. Demand for speculative purposes would not be included in this determination. Included in the evaluation of the need for additional leasing would be consideration of the progress and success of existing Federal leases



LANDS AVAILABLE FOR OIL SHALE LEASING
PREFERRED ALTERNATIVE

Figure III-18

and private oil shale projects in the region. Based on public input and the recommendations of the Regional Oil Shale Team, BLM would seek industry expressions of interest within the oil shale and other compatible management priority areas (see Figure III-18), delineate mineable tracts, and analyze the potential social, economic and environmental impacts on a site-specific basis. If it is determined that existing projects are developing diligently, a sequential lease-offering process shall be followed whereby critical environmental and socioeconomic carrying capacities are not exceeded. These critical carrying capacities or thresholds have been identified for air quality, water quality, wildlife habitat and population growth to nearby communities. Table III-9 summarizes these carrying capacities which are discussed in more detail under the appropriate headings in Chapter IV, Environmental Consequences. These carrying capacities constrain not only Federal oil shale leasing, but also private oil shale development and any other impacting development in the region. As development occurs and impacts are monitored, these carrying capacities may be reevaluated and raised or lowered as determined appropriate based on actual experience. While the limits to oil shale leasing established by these carrying capacities are flexible enough to reflect real impacts rather than predicted impacts, they are meant to be strong enough to prevent leasing before they are exceeded. The determination to lease or not will include an analysis of the environmental and socioeconomic impacts of that decision as well as the potential to exceed carrying capacities. This analysis will reflect existing conditions at the time the decision is to be made.

Some important variables must be taken into consideration in utilizing these carrying capacities. Most critical is the clear fact that once Federal oil shale leasing and development becomes lucrative, private oil shale development will surely begin in earnest simultaneously. This will mean competition for water, energy sources, air quality increments, population growth for communities, and other resources. As development occurs, ongoing environmental and socioeconomic impacts must be monitored to assure that cumulative impacts from all sources do not exceed these carrying capacities.

It is anticipated that renewed interest in private oil shale development to the south of the Piceance Basin would coincide with any future interest in Federal oil shale leasing. This means that private and Federal development in the region would be competing for environmental and socioeconomic growth limits. In addition, the Southwest Power Plant proposed near Grand Junction and other potential energy sources may become feasible and could potentially compete for air quality, water and population increments with the oil shale project developments they would support. Industry growth and impacts to the carrying capacity can, therefore, neither be viewed as static, nor as strictly Federally controlled. They must be monitored regionally, cumulatively, and through time, and even under the strongest economic pressures, impacts must be kept within the limits of the established carrying capacities of the environment and communities.

Oil shale land exchanges would be considered as proposed by BLM or private industry. An initial determination would be made as to whether such an exchange would be in the public interest. This determination must consider: Federal leasing that would be foregone due to private development on exchanged lands using up available carrying capacity; loss of base lands for grazing permits as lands offered in exchange to BLM; the manageability of the offered lands under BLM administration; loss of authority to require implementation of mitigation measures and due diligence requirements on exchanged lands; and the real opportunity for future oil shale leasing and development on offered lands. Private oil shale development on exchanged lands would be analyzed in terms of their impact on the carrying capacities described above, and would have the same geographic limits (i.e., reserve the multimineral zone) as Federal leasing. Priority would be given to consideration of exchanges of small Federal acreages that allow development on private lands to better accommodate a particular technology and logical land use pattern. Exchanging large blocked up tracts of Federal lands would be discouraged. Determinations of equal value will be made using the criteria established in 43 CFR 2201.3(c) for oil shale land exchanges.

The State of Colorado is currently considering identifying oil shale lands for selection as land due them from the Federal government. Once the acreage is established for this in-lieu selection, the State is encouraged to identify a logical mining unit within the oil shale management priority area to facilitate their subsequent leasing. Priority will be given to assisting the State in identifying a blocked unit that will accommodate future oil shale development. If insufficient acreage is available to the State for a logical mining unit, BLM will consider entering into a joint leasing arrangement with the State of Colorado whereby public lands would be added to the in-lieu selection lands to create a logical mining unit.

Research tracts would be considered by BLM on the merits of the technology proposed by the applicant. BLM may also propose research tract development to promote the goals of the Federal oil shale program. Consideration of such research leases would include a determination of the appropriateness of the oil shale resource for the technol-

TABLE III-9

SUMMARY OF CRITICAL CARRYING CAPACITIES[1] -- THRESHOLDS TO OIL SHALE DEVELOPMENT IN THE PICEANCE BASIN

RESOURCE	MEASUREMENT	THRESHOLDS	REMARKS
Air Quality	Ambient concentrations of pollutants in the air as determined by ambient monitoring and dispersion modeling..	Class II increments for SO_2 and particulates available in the Piceance Basin, and Class I increments in the Flat Tops Wilderness and other designated Class I areas in the region. Any level which is demonstrated to have adverse impacts on Air Quality Related Values (AQRVs) including visibility and acid deposition in Class I areas..	Current experience has shown that PSD increments are usually exceededbefore adverse impacts to AQRVs are demonstrated with the exception ofvisibility. As technology improves or if evaluation methodologies change, production rates may increase. Actual impacts must be monitored and compared to predicted rates. PSD permits act as effective limit to development, but not necessarily to leasing. Currently existing studies have estimated these limits to represent a cumulative shale oil production level for Piceance of 300,000 to 400,000 barrels per day. These estimates are based on assumptions of the general development scenario for the region as well as specific technologies and project production rates which are subject to change.
Social/Economic	Annual growth rate of affected communities..	As determined through consultatons with local officials of affected communities. Guidelines to be used in making this determination: 5-15%..	Most authorities place the critical rate beyond which social change is disruptive between 5% and 15%, depending on the duration and adequacy of mitigation. Economic carrying capacity is more difficult to define, but easier to mitigate. Local officials would be consulted prior to making a decision not to lease based on social/economic carrying capacity. If sufficient mitigation is proven and local officials can demonstrate an ability to accommodate it, higher growth rates could be allowed; if not, postponement of development or staggered leasing would be considered.
Wildlife	Habitat carrying capacity to support wintering mule deer on public land in the Piceance Basin..	The habitat needed to maintain 24,900 mule deer (24,650 AUMs)..	This figure is 83% of actual wintering Piceance Basin herd of 30,000 on all lands, the minimum acceptable herd size agreed to by BLM and Colorado Division of Wildlife. Actual location, size and duration of surface disturbance affects amount of leasing allowed. Stringent wildlife habitat mitigation may be imposed instead of prohibition of leasing depending on actual site-specific and cumulative adverse impacts to mule deer. Livestock grazing use would not be reduced by the BLM to decrease livestock/wildlife forage competition or to supplement forage available to wildlife for the purpose of avoiding the violation of this wildlife theshold.
Water Quality	Discharge water quality of individual projects..	Stream standards as prescribed by NPDES permiting regulations issued by State of Colorado for specific projects. Allowable pollutant concentrations based on stream ratings as classified by State of Colorado..	The Colorado Department of Health-Water Quality Control Commission issues NPDES permits on case-by-case basis for projects, based on their analysis on water quality of anticipated discharges. Pollutant discharges may not exceed water quality limits established in the Classification and Numeric Standards, Colorado River Basin. Actual cumulative water quality impacts must be monitored to assure analysis is sufficient to determine whether to issue permit.

[1] See text for definition of critical carrying capacity and what these thesholds mean. The threshold and the information provided under REMARKS is summarized from discussions included under the appropriate heading for each resource in Chapter IV, Environmental Consequences.

ogy-testing that is proposed, the potential environmental and socioeconomic impacts of such a lease and a determination of whether the lease is in the public interest. No commercial-scale operations would be considered under this provision. While tract size is not specified, it is anticipated that research leases would not exceed 2,000 acres. Research tracts would be permitted in the multimineral zone.

Offsite leases for overburden and spent shale disposal would be considered within the limits and

constraints of existing laws and regulations, giving careful consideration to the resource values that may be foregone, the potential environmental impacts of such a lease, and whether such a lease would be in the public interest. If legislatively authorized, these offsite leases would be considered in sufficient size to accommodate private or Federal oil shale development where such a lease is proven necessary for successful operation.

Sodium

All public lands in the planning area would be excluded from further sodium-only mineral leasing until the existing sodium leases are developed or a proven demand arises. Sodium-only leasing would not occur if such development would reduce the recoverability of the oil shale resource. Multimineral recovery (sodium and oil shale) would be encouraged rather than sodium-only, once the criteria for leasing in the multimineral zone is met (see discussion under Oil Shale for the Preferred Alternative). Site-specific leasing restrictions to protect other resources would be imposed prior to leasing or exploration where another resource was shown as having priority. Standard lease stipulations would apply as referenced in the leases.

Coal

All Federal lands with potential for coal development and acceptable for surface or underground coal mining would be open for future leasing. This includes 29,610 acres acceptable for underground mining; of this 29,610 acres, 24,635 acres are also acceptable for surface mining. Site-specific restrictions may be imposed to protect other critical resource values. Restrictions would become part of the lease on approved mine plans.

Development and exploration of new and existing oil and gas mineral leases would have priority over coal development. Future coal leasing would provide for the future extraction of the oil and gas minerals through stipulations in the coal lease.

Oil and Gas

All public lands in the planning area would continue to remain open to oil and gas leasing. Known Geologic Structures (KGS) and future redelineations of them would have the greatest potential for development and would be committed to the exploration and development of oil and gas resources. Standard oil and gas lease stipulations would apply to the area. Future oil shale leases within the management priority area for oil and gas (Known Geologic Structures and any future redelineations of them) must provide for the development of oil and gas prior to or concurrently with oil shale development through stipulations in the oil shale lease. (This does not apply to lands that are already leased for oil shale that subsequently are included in a Known Geologic Structure). In addition, the site-specific or temporary restrictions specified in the *White River Resource Area Oil and Gas Leasing Umbrella Environmental Assessment* (USDI, BLM February 1982) would be imposed prior to leasing or exploration to protect other important resources, and to plan for orderly development of the resource. New or reissued leases may be subject to additional stipulations for other critical resource values when issued.

Locatable Minerals

All public lands in the planning area would remain open to entry for exploration, location and development of locatable minerals under the provisions of the General Mining Law of 1872 as amended, except those lands under protective withdrawal that would be excluded from mineral entry. Lands classified for disposal under the Recreation and Public Purposes Act are also closed to mineral entry (see Lands and Realty Section). Development and certain types of exploration could have site-specific or temporary restrictions imposed to protect other important resource values.

Saleable Minerals

Public lands would be available to provide mineral materials to meet the demands not filled by private enterprise and would provide free materials to local, state and Federal agencies for road maintenance and construction. An inventory of mineral materials would be conducted to identify new sand and gravel sites and the quantities available at existing sites. Existing or previously used sites would be favored. Sand and gravel development would be excluded from mandatory protection areas. Site-specific restrictions would be required on a case-by-case basis to protect other resource values.

WATER RESOURCES

Complete the 1984-1985 spring and stream channel stability inventory (see Current Management Alternative), and establish baseline conditions based on the results of the inventory. Watershed management plans would then be developed to maintain streams that meet state water quality standards and/or protect from further degradation

those streams that do not meet state standards. Streams on public lands in the planning area that meet or exceed State water quality standards and have acceptable channel stability would be maintained in their present condition through management practices such as:

1. Monitor water quality or stream bank stability.

2. Improve vegetation cover on watersheds by developing grazing systems for livestock that would provide an increase in plant density and stabilize the soil.

3. Initiate streambank stabilization projects.

4. Develop grazing systems and land improvements that improve animal distribution and reduce livestock concentration in important riparian areas.

5. Construct check dams on intermittent stream drainages to reduce sediment load caused by upland erosion.

6. Apply recommendations made in the Northwest 208 Plan to Bureau water quality control and improvement projects, if feasible. Ensure that the best management practices available are incorporated.

To protect from further degradation those streams that do not meet state water quality standards the following management practices would be initiated.

1. Exclude surface disturbing activities from watersheds where they were contributing to, or had the potential for contributing to, degradation of water quality.

2. Provide buffer strips between streams and surface disturbing activities, such as mining, road building, clearcutting trees, etc.

3. Ensure rapid revegetation of disturbed areas.

4. Utilize water course structural engineering practices (gully plugs, gabion structures, dams, riprap, etc.).

5. Limit ORV usage within the watershed.

6. Control erosion or runoff on disturbed sites.

7. Limit vegetation manipulations or treatments within the watershed to spraying, aerial seeding or designed grazing systems.

8. Place time restrictions on surface disturbing activities to avoid spring thaw and runoff seasons.

9. Construct snow management structures for watershed improvement.

10. Comply with all Federal, state and local water quality regulations.

In addition, the Bureau would cooperate with other agencies or adjacent land owners to improve water quality on a case-by-case basis for streams that do not meet state standards.

To the extent possible, groundwater would be protected to maintain present quantity and quality. Spring and stream reliant use supplied by groundwater must be mitigated when affected by mineral development. This would be achieved by placing restrictions on activities that may penetrate into subterranean water or by providing alternate water sources. Degradation by toxins and other impurities would be regulated by present management practices, additional stipulations would be placed on groundwater usage and disposal on a case-by-case basis.

In this alternative, BLM would encourage the establishment of an industrial association of mineral developers to coordinate monitoring and mitigation efforts of those industries that affect the groundwater resources within the planning area. Monitoring and mitigation requirements to protect the groundwater would also be stipulated on mining activities by state and Federal agencies, the lessee or the industrial association.

SOILS

During pre-project planning and investigations, detailed soil maps are used and soil properties are analyzed to determine soil productivity potential and engineering suitability. This avoids surface disturbance on unsuitable sites. Onsite soil investigations are used to make specific recommendations on project locations. Areas with high wind and water erosion susceptibility, saline soils and especially steep clayey slopes would be avoided where possible. Reclamation measures would be stipulated to maintain soil productivity and stability. Additional compliance work would be performed to ensure reclamation stipulations are adhered to. Seasonal road closures would be enforced during periods when the soil surface is saturated to a depth of three inches. An improved road maintenance program would be implemented to minimize erosion losses.

FORESTRY

Objectives for sawtimber and pinyon-juniper are to manage, in perpetuity, forested areas on a sus-

tained annual yield basis. This also includes managing forested areas for multiple resource values. Specific management actions would be identified through preparation of a comprehensive forest management plan.

Objectives would be achieved primarily through the sale of forest products. This would be implemented through advertised and negotiated commercial sales and individual negotiated sales. The current White River Resource Area's 5-year sale plan would be implemented. This plan identifies the annual commercial sale of approximately 2,500 cords of pinyon-juniper firewood and 250,000 board feet of Douglas fir sawtimber. Compliance checks would be necessary on all existing and proposed timber sales. Additional product sales to individuals would be handled on a case-by-case basis.

When energy development actions impact forested areas, developers would be required to purchase all timber products prior to project commencement. Stipulations for timber disposal and rehabilitation of these project sites would be included on each development action.

LIVESTOCK GRAZING

Management of livestock grazing in the Piceance Basin would essentially continue as identified in the Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement (USDI, BLM April 1980) and summarized in the Current Management Alternative in this chapter. Forage allocation to livestock would be increased from the current maximum authorized use of 57,016 AUMs to 64,011 AUMs over the long-term. Allotment Management Plans (AMPs) would be developed for each allotment in the study area. Two categories of AMPs are proposed: intensive and less intensive.

Five allotments are presently under intensive management with developed AMPs and would continue to be managed this way: Dry Fork, Segar Gulch, Piceance Mountain, Reagles and Square S. Intensive management and development of AMPs would be initiated on 24 additional allotments. Grazing systems and specific range improvements would be identified as AMPs are developed. Allotment Management Plans would be designed to coordinate livestock grazing with other land uses to meet multiple use objectives. Intensive monitoring and study programs would be conducted on each allotment proposed for intensive management.

Less intensive management is proposed for Lower Fourteen Mile, Puckett Gulch and Pine Knott Gulch, Powerline and Skinner Ridge allotments. These allotments involve small acreages of public land making it impractical or uneconomical to administer the intensive management practices identified above.

Implementation of AMPs was originally scheduled for completion by 1988 in the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980). However, based on present funding levels full implementation may not be achieved until the year 2000.

The White River Trail would continue to be available for livestock trailing. Mitigation of impacts from energy development would be required. Use adjustments may be necessary on allotments when oil shale development occurs and would continue until forage lost to disturbance is replaced.

WILD HORSES

Wild horses would be managed to maintain a maximum herd population of 100 by 1988. This would require a forage allocation of approximately 1,600 Animal Unit Months (AUMs). Since an estimated 159 wild horses currently reside in the planning area, removal operations would be required to reduce populations to desired levels. Follow-up horse removal operations would be necessary to maintain populations within this level. Projects would be implemented to provide forage and water to sustain this herd. Mitigation of negative impacts due to energy development would be required. Use adjustments may be necessary on the Herd Management Area when oil shale development occurs and would continue until forage lost to disturbance is replaced.

WILDLIFE

All wildlife habitat would be managed with emphasis directed to crucial habitats of threatened and endangered species, raptors, mule deer, elk and sage grouse. The existing Piceance Basin Habitat Management Plan would be implemented.

Initial forage allocation to wildlife would be 36,253 AUMs. This level of allocation would sustain short-term BLM and Colorado Division of Wildlife big game population objectives for the planning area. This allocation would be increased to 40,501 AUMs over a 20 year period, allowing mule deer and elk populations to increase by 12 percent and 8 percent, respectively. This would achieve long-

term BLM and Colorado Division of Wildlife big game population objectives.

Wildlife habitat improvement projects would be directed to increased production and condition of big game winter forage. Off road vehicle (ORV) restrictions would be enforced during crucial time periods on essential wildlife habitat areas to minimize disturbances. Current research efforts would be continued to collect data necessary for proper management. A detailed monitoring system would be developed and implemented for species of management emphasis.

Allotment Management Plans would be designed and developed to achieve wildlife objectives identified in the White River Resource Area Management Framework Plan (USDI, BLM 1981). Studies and monitoring programs would be implemented to assess attainment of these objectives. All range projects and forest product sales would be implemented subject to standard operating procedures and design restrictions. Wild horse populations would be controlled on the designated Herd Management Area to minimize competition with wildlife. A Fire Management Plan would be implemented to allow beneficial effects of wildfire in designated areas. Reclamation restrictions to replace wildlife habitat would be placed on all energy development actions. Seasonal and locational restrictions would be applied only on crucial wildlife ranges. Population adjustments may be necessary on areas when oil shale development occurs. This adjustment would occur until forage lost to disturbance is replaced. An industrial association of mineral developers would be encouraged to better coordinate mitigation efforts and improve technology to reduce site-specific and cumulative impacts to the wildlife resource from energy development.

THREATENED, ENDANGERED, RARE AND SENSITIVE PLANTS AND REMNANT VEGETATION ASSOCIATIONS

The avoidance stipulation would be applied to man-induced surface disturbing activities to prevent disturbance on the habitat of known populations of rare and sensitive plants and selected occurrences of remnant vegetation associations listed in Table III-10 whenever possible except where prohibited by valid and existing rights. On-the-ground surveys for rare and sensitive plant species would be required prior to any surface disturbing activity in areas of potential habitat on public land. Proposed man-induced surface disturbing activities in or adjacent to the remaining remnant vegetation associations would be evaluated on a case-by-case basis to determine necessary management actions.

TABLE III-10

REMNANT VEGETATION ASSOCIATIONS SELECTED FOR APPLICATION OF AVOIDANCE STIPULATION

Remnant Vegetation Association	Population		Proposed Special Management Area Name	Acres
	Ranking [1]	Number [2]		
Utah juniper/ saline wildrye	A1	C2001	School Gulch	33.24
		C2003	School Gulch	69.95
Pinyon pine/Utah serviceberry-greenleaf manzanita-true mountain mahogany/ sedge	A1	C14002	Upper Greasewood Ck	46.69
Pinyon pine-Utah juniper/ beardless wheatgrass	A2	C4007	Dudley Bluffs	7.44
Utah juniper-pinyon pine/ Utah serviceberry-true mountain mahogany	A2	C7001	Upper Greasewood Ck	82.41
Utah juniper-pinyon pine/ blacksage/ beardless wheatgrass	A2	C1001	------	10.19
Wyoming big sage/ shadscale/ saline wildrye	A2	E1005	Blair Cliffs	10.40
Shadscale/ beardless wheatgrass/ Indian ricegrass	A1	F2001	King Gulch	3.99
		F2002	King Gulch	8.47
		F2003	Dudley Bluffs	3.33
Shadscale/saline wildrye	A1	F3001	Spring Gulch	43.17
		F3002	Spring Gulch	84.40
Beardless wheatgrass grassland	A1	J1004	Lower Hay Gulch	3.53
		J1001	King Gulch	.89
Beardless wheatgrass-Indian ricegrass	A1	J2002	Deer Gulch	2.33

[1] Ranking refers to categories assigned by the Colorado Natural Areas Program. A1 = Highest National Priority. A2 = High National Priority.

[2] Population number refers to numbers assigned by The Nature Conservancy in their inventory of the Piceance Basin (copies available in the White River Resource Area office).

Festuca dasyclada populations in the Deer Gulch area and population 08B086 would be monitored to

evaluate livestock grazing impacts. The three *Gilia stenothyrsa* populations in the planning area would also be monitored. No Surface Occupancy stipulations would be established for the *Aquilegia barnebyi* population in McDowell Gulch, the*Astragalus detritalis* populations 02P004 and 02P005, and the *Festuca dasyclada* and*Astragalus lutosus* populations in the Deer Gulch area. Selected populations of rare and sensitive plant species in the South Cathedral Bluffs area would be fenced for protection from livestock grazing and monitored to compare grazed and nongrazed situations in this specific location. Monitor the *Artemisia tridentata spp. tridentata/Elymus cinereus* plant association D4002. Develop allotment management plans incorporating methodology for managing plant associations C14001, C14002, C14003, C7001, C7006, E5002, and J3002. Monitor plant sites 20W074 and 20W075 of *Physaria obcordata*.

Fifteen selected remnant vegetation associations would be afforded protection using the avoidance stipulation for future development. These remnant vegetation associations are listed in Table III-10. Avoiding disturbance on these sites would ensure protection of at least one site for each of the ten remnant vegetation associations found in the planning area which have been ranked by the Colorado Natural Areas Program as being of Highest and High National Priority. The locations for avoidance of rare and sensitive plants and the selected remnant vegetation associations would be included in the *White River Resource Area Oil and Gas Umbrella Environmental Assessment* and would be analyzed for application as a no surface occupancy stipulation on future new or reissued leases.

Maps indicating known locations of these habitats and plant sites are available for review in the White River Resource Area office. Additional protective management measures are identified in Appendix B for proposed and designated Special Management Areas that include habitat for rare and sensitive plants.

CULTURAL RESOURCES

Intensive management of cultural resources would include all aspects of current management (see Current Management Alternative). In addition, management would involve analysis of the cultural resources in the planning area and adequate interpretation. This would provide a clearer understanding of the extent and significance of the resources present and would answer regional research questions.

The management practices to be employed would include the following:

Analysis - A representative sampling of cultural sites would be excavated and analyzed in order to answer regional research design questions.

Interpretation - An interpretive program would include the installation of informational signs at major site locations which would explain the resource. A permanent display would be installed in the lobby of the White River Resource Area office building which would exhibit artifacts and reproductions of rock art in the area.

Public Awareness - Public education would be used to reduce vandalism of cultural sites on public lands. This would include the use of informational signs, talks to community and school groups, and publication of educational brochures.

PALEONTOLOGICAL RESOURCES

Under the mandate of the Antiquities Act of 1906, Section 30 of the Mineral Lands Leasing Act of 1920, the National Environmental Policy Act of 1969 and the Federal Land Policy and Management Act of 1976, the Bureau of Land Management would be required to identify, evaluate and protect paleontological resources within public lands.

A classification system based on the significance or potential significance of paleontological resources within respective geologic formations has been developed by the Bureau of Land Management. This classification system and the geologic formations the classes occur in (within the planning area), are described in Table III-7. Figure III-8 illustrates the paleontological classifications present within the planning area.

RECREATION

Under intensive management, user areas and services providing for the health, safety and convenience of the public and protection of the resource would be actively managed. The planning area would be managed as an Extensive Recreation Management Area, except within the high hunting use areas which would be managed as a Special Recreation Management Area (SRMA) (see Figure III-15). Future recreation sites within the SRMA would be developed as use and need increases with protection of the recreation resource and upgrading of the quality of the user experience a primary management objective. A Recreation Area Management Plan would be developed for the SRMA that identifies specific projects and management actions necessary to minimally meet program

objectives, user needs and demand. The Recreation Area Management Plan would identify access and parking in high use areas that need to be improved. A seasonal visitor services program for hunters would be established which would include a field program and information stations.

Areas of resource conflicts would be restricted (closed) either permanently or seasonally, to off-road vehicle (ORV) use to reduce or eliminate adverse impacts. Administrative and operational actions would be taken to facilitate road closures. Closures would be proposed to protect the 160 acre Soldier Creek ACEC (permanent) and crucial wildlife habitat (seasonal), totalling 162,500 acres. Other closures or restrictions could be seasonally implemented in order to protect soils and watersheds under severe conditions (see Appendix C for more details).

A Non-motorized Hunting Area would be established within the Cow Creek unit of the SRMA after completion of a Recreation Area Management Plan. This would be an area of some 2,000 to 5,000 acres that would be closed to motorized vehicles during big game hunting season, except for users with prior valid and existing rights. The exact size, location and management actions to be taken in the Non-motorized Hunting Area would be detailed in the Recreation Management Plan. All other areas would be open to ORV use.

Increased public information efforts would include the publication of a map which shows roads, trails, information stations, campsites and other recreation information of interest to the public. A road sign program will also be developed and implemented.

Public access points along the White River would be identified and developed as use increases. Cadastral survey would be required to precisely identify BLM ownership along the White River.

The Recreation Area Management Plan and ORV Implementation Plan would be scheduled for completion within one year of publication of the final RMP.

Management would result in a more diverse opportunity setting, thereby providing more choices in types of recreation available. Recreation management objectives would be to maintain established Recreation Opportunity Spectrum (ROS) classes once all practices are implemented. More public lands would be accessible and the water-based recreation resource would become readily available. This would help satisfy user demand and allow more freedom of choice. Needs identified in the Colorado State Comprehensive Outdoor Recreation Plan, including picnicking, 4-wheeling, nature study and camping would be met.

VISUAL RESOURCES

Visual resource management (VRM) would remain a support activity for other resource programs and subactivities. Visual design would be emphasized as a means to reduce the contrast of projects with moderate to high impacts or projects which are proposed in sensitive areas.

The contrast rating system, as described in the revised BLM policy guidelines for VRM (IM No. CO-83-234), would be implemented. It is the responsibility of the program which is initiating development activity, to ensure that visual values are adequately maintained.

TRANSPORTATION

Criteria for transportation management are outlined in the following documents:

- BLM Manual Sec. 9112 (Bridges and Culverts) and Sec. 9113 (Roads);
- Craig District Transportation Plan;
- White River Resource Area Oil and Gas Umbrella Environmental Assessment;
- Surface Operating Standards for Oil and Gas Development; and
- Site-specific stipulations developed through right-of-way applications, APDs and mining plans.

Existing transportation systems are sufficient to handle current access needs for multiple use management. BLM would provide access for additional product transportation needs as demand occurs. The District Transportation Plan (secondary roadways) would be updated to plan for the needs of the Piceance Basin. Unnecessary roads would be abandoned and reclaimed. Coordination with state and county road development would be facilitated through Memoranda of Understanding. Improvement of existing state and county (primary) roadways would be facilitated by making the public lands available for sand and gravel resources. Submission of a Five Year Plan of Development for oil and gas fields as described in the existing *White River Oil and Gas Umbrella Environmental Assessment* would be requested for new or reissued leases in order to assist BLM in identifying and mitigating the cumulative impacts of access roads and pipelines. Once a non-unitized lease becomes capable of hydrocarbon production, the lessee shall submit an annual Plan of Development for that lease if new or additional operations are expected

to occur within the forthcoming year pending approval by Office of Management and Budget of this information collection requirement.

The construction of new access roads, pipelines, transmission lines and other transportation needs would be encouraged, through the permitting process, to be placed in designated right-of-way corridors. These corridors are shown on the Preferred Alternative map in the Map Addendum and are described below under Lands and Realty, Use Authorizations.

LANDS AND REALTY

The lands and realty program is charged with legally authorizing the use of public lands. The program is broken down into energy and nonenergy uses which may be defined by use authorizations and land title transfers. Use authorizations involve corporate and governmental entities' use of public lands for project location. Land title transfers include actions involving the eventual transfer of title between entities.

Use Authorizations

Applications for use authorizations would be processed and approved on a case-by-case basis. Locations and routes would be situated in an economically and environmentally sound manner emphasizing development on previously disturbed sites and/or designated utility corridors. Use authorizations include temporary use permits, rights-of-way, permits, leases, easements and communication sites. Use authorization actions could include access roads, pipelines, powerlines, utilities, railroads, etc. and must meet the following criteria:

1) Applications must meet the requirements of existing law and Bureau policy.

2) Placement on or use of the public lands must not be in conflict with the lands specific to critical resource needs, their buffer zones, or protection of those areas.

3) Applications support private or governmental needs on a local or regional basis.

Rights-of-way

Rights-of-way would be processed and approved by the White River Resource Area staff as the need occurs. This process would consist of a multiple-use conflict analysis and an identification of required resource mitigation prior to authorization. In addition to the oil and gas pipelines identified in Chapter II, Transportation, numerous rights-of-way would be issued for oil and gas access roads, electric powerlines and utilities associated with the oil and gas development. Detailed descriptions and the location of existing rights-of-way may be obtained from the White River Resource Area office.

Temporary Use Permits

Temporary use permits would be issued to authorize temporary use of public lands in conjunction with a right-of-way, and therefore would be analyzed through the right-of-way process on a case-by-case basis.

Leases, Permits and Easements

Section 302 of the Federal Land Policy and Management Act of 1976 (FLPMA) provides use authorization under certain conditions for varied periods of time. These authorizations would be considered on a case-by-case basis. While most of these authorizations within the Piceance Basin are associated with oil shale development, the law provides for a wide variety of uses.

Utility Corridors

Major linear rights-of-way such as roads, pipelines and transmission lines would be located whenever possible within designated corridors. Corridors would be designated in order to provide future lands necessary for those utility uses described in the *1980 Western Regional Corridor Study* (Public Service Company 1980), provided they do not conflict with more important resource values. Routing of major linear rights-of-way outside of designated corridors would be allowed provided they are located to avoid steep topography, poor soils, high visual sensitivity areas, known rare and sensitive plant locations or other fragile areas such as threatened and endangered species habitat and cultural sites. In addition, priority corridors would be designated up to but not within the oil shale open pit management priority area. Instead, the applicant would be encouraged to consult with private industry and the Federal government to find a route that would be least impacting to those resources. These criteria would be applied to any major linear right-of-way application. Processing of major linear rights-of-way would be speeded by preliminary application of these criteria should the applicant choose not to locate within a designated corridor.

Designated corridors may be used only for those uses for which NEPA compliance has been completed. If a designated corridor has a right-of-way

application which is different from the use for which the corridor was designated, then an appropriate environmental review will be required for that use. Most of the proposed corridor designations have previous environmental analyses. Following is a description of the proposed corridors, their designated uses (see Figure III-12 for location), and the environmental review (if any) necessary for each use. These corridors are also shown on the Preferred Alternative map in the Map Addendum.

Bar D Mesa-Blair Mesa -- Starting in the middle of the basin, this corridor is located on the divide between Yellow and Piceance Creeks and heads north to the White River. This corridor would be designated for major pipeline, utility and road transportation use. A detailed environmental review would be necessary for liquid product, gas and electrical transmission lines use. Road transportation use would require an environmental review only in the northern portion of the corridor.

Black Sulphur Creek -- Starts approximately in the middle of the basin and heads directly southeast along the Black Sulphur Creek drainage system. This corridor would be designated for major pipelines, utility and road transportation use. A detailed environmental review would be necessary for electrical transmission line use.

Calamity Ridge -- This corridor is located on the northwest edge of the basin and heads north to the White River following the Calamity Ridge Road. This corridor would be designated for major pipeline, utility and road transportation use. A detailed environmental review would be necessary for liquid product and gas pipeline use.

Cathedral Bluffs -- Located on the west boundary of the basin, this corridor heads south from the Calamity Ridge corridor to the Roan Plateau corridor. This corridor would be designated for major pipeline and road transportation use. A detailed environmental review would be necessary for liquid product and gas pipeline use.

C-b -- This corridor is located between Piceance Creek and the north side of Tract C-b. This corridor would be designated for major pipeline, utility and road transportation use.

Collins Gulch -- This is a short corridor located north of C-b corridor and Piceance Creek and heads north up Collins Gulch toward Magnolia Camp. This corridor would be designated for major pipeline, utility, and road transportation use. A detailed environmental review would be necessary for electrical transmission line use.

Colony -- This corridor is located on the southeast rim of the basin and runs south from the Roan Plateau corridor to Parachute Creek. This corridor would be designated for major pipeline, utility and road transportation use. A detailed environmental review would be necessary for electrical transmission lines and road transportation use.

Cottonwood Draw -- This is a short corridor connecting the open pit mine area to the Calamity Ridge corridor on the northwest part of the open pit mine area. This corridor would be designated for major pipeline, transmission line and road transportation use. A detailed environmental review would be necessary for liquid product and gas transmission lines.

Joe Bush Mountain -- Starts on the east side of the basin and heads southwest to Piceance Creek and the White River City-Rio Blanco corridor. This corridor would be designated for major pipeline and utility transmission line use. A detailed environmental review would be necessary for electrical transmission lines. Liquid product and gas transmission lines would need a detailed environmental review in the northern portion only.

Kendall Point -- Heads northeast from Piceance Creek and the C-b corridor across Kendall Peak and north to the White River. This corridor would be designated for electrical transmission line use.

La Sal -- This corridor starts in the southeast portion of the basin connecting with the Roan Plateau and Colony corridors and heads north to Magnolia Camp, then west to the open pit mine area and then northwest to the Calamity Ridge corridor. This corridor would be designated for major liquid product and gas transmission lines.

Little Hills -- This corridor is located in the northeast part of the basin and connects the White River City-Rio Blanco corridor in a northeast direction to the Rifle-Meeker corridor. This corridor would be designated for major pipelines, utility and road transportation use. A detailed environmental review would be necessary for electrical transmission lines.

Rangely-Meeker -- This corridor starts at the extreme northeast corner of the planning area in Powell park and heads west toward Rangely paralleling the north boundary of the planning area along the White River and Highway 64. This corridor would be designated for major pipeline and utility line use.

Rifle-Meeker -- This corridor heads south from Meeker along highway 13 on the east side of the basin towards Rifle. This corridor would be designated for major pipeline, utility and road transportation use.

Rifle-Roan Plateau -- Starting at the extreme southeast corner of the basin this corridor heads west along the Roan Plateau to the far southwest corner of the basin. This corridor would be desig-

nated for major pipeline, utility and road transportation use. A detailed environmental review would be necessary for electrical, liquid product and gas transmission lines.

White River City-Rio Blanco -- This corridor starts at approximately the junction of highway 64 and Rio Blanco County road 5 and heads south to Magnolia Camp. From Magnolia Camp it heads southeast to Piceance Creek. This corridor would be designated for major pipeline, utility and road transportation. A detailed environmental review would be necessary for electrical transmission lines and partially in the northern portion for liquid product and gas transmission lines and road transportation.

Land Title Transfers

The Bureau would process land title transfer actions such as sales, exchanges, recreation and public purpose actions and acquisitions where overall land management would be improved.

Sales

The policy for the disposal of lands in the planning area would be to consider proposals as needed for public land administration, private land needs and industrial development under the authority of existing laws. Requests for purchasing public lands in the planning area are expected to be rare, and primarily involve small isolated parcels of land with low mineral potential.

BLM is in the preliminary stages of developing a land disposal program to identify lands and mineral resources for consideration for sale or transfer from public ownership. An initial inventory identified some 850 acres of public land as potentially meeting one or all of the criteria for sale or transfer. In addition to these lands, sale priority would be placed on those lands which meet one or more of the following criteria giving highest priority to the order which the criteria occur.

1) Lands proximate to cities, towns or development areas.

2) Scattered non-urban tracts located so as to make effective and efficient management impractical.

3) Lands designated for agricultural, commercial or industrial development by current land use trends as its highest and best use.

4) Lands adjoining other Federal or State lands that could be better managed by those entities.

5) Lands meeting any or all of the three criteria specified in the Federal Regulations 43 CFR, Part 2710.0-3.

5) Public lands within Management Priority Areas may be disposed of through sale provided:

a) Sale would not significantly affect or change the levels of production or use as approved in the Resource Management Plan.

b) Sale would not change resource conditions, goals or objectives and the time required to meet the same.

c) Sale would not result in a change in program constraints or practices described in the Resource Management Plan.

7) Mineral estates without economic mineral value and where Federal mineral ownership would interfere with surface estate development and where development would be more beneficial than the mineral estate development.

8) Lands and minerals that do not quality for sale under section 203(a) or 209(b) of the Federal Land Policy and Management Act but which are suitable for disposal through other applicable law.

When the land disposal program is fully implemented, the remainder of the planning area would be categorized as appropriate for retention by the Federal government, or requiring additional studies to determine whether it is appropriate for retention or disposal.

Acquisition

The Bureau would process, initiate and favor actions for consolidation and easement to public land where overall land management would be improved. Emphasis would be placed on aquisition of those lands that improve access to public lands. No acreage limitations would be placed on such actions. Lands or interests to lands considered for acquisition would include:

1) Lands adjacent and controlling access to intensively managed tracts of public land where overall program management would be enhanced, such as lands adjacent to intensively managed hunting areas, grazing allotments or important mineral areas.

2) Private or state land within large blocks of public lands.

3) Lands of mineral importance where the Federal minerals are overlain by State or private surface ownerships.

Exchanges

Land exchanges on lands not having oil shale mineral reservations would be evaluated for land values, renewable resource values, and/or other mineral values. Land exchanges containing oil shale or oil shale and associated mineral values will be based on a determination of equal value for both offered and selected lands. The equal value would be based on either: 1) a simple recoverable ton for ton or recoverable synthetic crude barrel for barrel, or 2) an adjusted resource for resource equivalent based on the criteria established in 43 CFR 2201.3(c).

Recreation and Public Purposes

The Recreation and Public Purposes Act (R&PP) allows for the sale or lease of lands to existing communities to meet the demand for lands that benefit the public at large.

Public land potentially suitable for development within a five mile radius of the corporate boundaries of the towns of Meeker and Rangely would be identified for community expansion and use. If growth of the existing communities increases too dramatically and it is determined by local officials that development is required outside the communities, Rio Blanco and White River City should be considered as logical sites. Development at these points would place new community development away from direct conflicts with oil shale development and serve as a release valve for local communities. The decision to allow growth in these locations would be made by local officials based on the Rio Blanco County Master Plan. BLM would act only to support this decision by providing necessary lands for purchase or lease for community expansion. Lands that are specific to critical resources such as wildlife, threatened and endangered species habitat, fragile soils, steep slopes and sensitive watersheds would not be available for community expansion. Lands with existing Federal energy and mineral leases would remain open to community expansion provided the uses are compatible. Should a conflict occur between community expansion and development of the Federal energy and mineral leases, the energy and mineral development would have priority over community expansion. All Recreation and Public Purpose (R&PP) actions would be restricted as necessary to protect other resources as identified on a case-by-case basis. R&PP sales would recognize the prior rights of Federal energy and mineral lease holders.

FIRE MANAGEMENT

Under this alternative, the management objective would be to prepare and implement a Fire Management Plan. This plan would provide the guidance required for proper management of wildfires in the planning area. It would permit the option of immediate suppression in areas requiring protection from wildfire or allow fires to burn naturally in areas where desired resource benefits would occur. Wildfire control measures would be developed and recommended for implementation in each fire management area.

Prescribed burn policies and planned accomplishments would be implemented as identified in the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement (USDI, BLM April 1980) and as identified in the Bureau's Air Quality Maintenance requirements, described in the Current Management Alternative.*

SPECIAL MANAGEMENT AREAS

Soldier Creek would be designated with adjusted boundaries (totalling approximately 160 acres) as an Area of Critical Environmental Concern (ACEC). This site provides habitat for five populations of three rare and sensitive plant species, including *Aguilegia barnebyi* a species dependent upon an aquatic habitat. Management is necessary to maintain the quality of this relatively undisturbed watershed for the rare and sensitive plant species present and the state listed threatened Colorado River Cutthroat Trout which inhabit the lower stretches of this drainage.

Management of the other Special Management Areas proposed for the Wildlife Alternative would include several types of protection. These are described in Appendix B.

Chapter IV
Environmental Consequences

CHAPTER IV
ENVIRONMENTAL CONSEQUENCES

This chapter analyzes the cumulative impacts to the environment and communities in the region of the resource management alternatives presented in Chapter III. Since the alternatives are descriptions of management emphases and primarily direct future decision-making in the Piceance Basin, and do not propose specific, on-the-ground projects or actions, the environmental consequences of the alternatives are identified in comparative, general terms. In most cases, subsequent analysis will be required to implement decisions that are made in this plan, and more detailed or site-specific studies will be conducted in compliance with the National Environmental Policy Act and its implementing regulations.

The chapter discusses impacts by environmental element (air quality, soils, social and economics, etc.), and then comparatively for the alternatives within each environmental element in order to emphasize the differences in impacts anticipated for each alternative.

At the end of this chapter is a summary of the impacts, including a comparative table (Table IV-10), and a restatement of the unavoidable, adverse impacts anticipated for each environmental element, the relationship of short-term use of the environment to the long-term productivity of the resources, potentially irreversible or irretrievable commitments of resources, and uncommitted mitigation measures suggested for impacted resources.

In order to perform this analysis, some baseline assumptions had to be made. The interdisciplinary team agreed to some basic project assumptions for the region that could safely be used as a basis for adding the additional impacts from the resource management alternatives to arrive at a cumulative impact for each environmental element. Additional assumptions were also made for oil shale development that could reasonably be expected to occur under each alternative, and for committed mitigation measures assumed to be implemented under each alternative. All these assumptions are described below. Additional assumptions that would only affect the analysis of a single environmental element, are identified in the narrative for that element. The assumptions were developed to provide a best guess of the development that would occur if management practices identified in each alternative were implemented, so that the potential impacts could be predicted. Nothing in these assumptions should be interpreted as constraining or redefining the management practices proposed for each alternative as described in Chapter III. These assumptions were developed for impact analysis purposes only.

Oil shale projects assumed in the baseline include Federal oil shale tracts C-a and C-b and a third prototype tract (C-11 or C-18) in the Piceance Basin. Also assumed is private oil shale development south of the basin along the Roan Plateau. Total Colorado shale oil production by the year 2000 would amount to some 233,400 bbl/day, employing some 8,350 workers at full production. Nearby Utah projects would contribute to the baseline as well, so some 206,400 bbl/day shale oil production has been assumed, with approximately 8,250 workers directly employed in the oil shale industry in Utah. (More information on how this baseline was constructed is available at the White River Resource Area Office.)

Added to this baseline under each alternative were additional Federal oil shale projects that could reasonably be expected to be leased over the next twenty years, given the management objectives of each alternative. These assumptions are shown in Table IV-1.

It should be reiterated that this Resource Management Plan is only attempting to identify a range of potential impacts from a range of alternatives, and is not trying to analyze the site-specific impacts of oil shale or other developments. At the time oil shale or other leasing is to occur, the best available data will be used to analyze potential impacts, including updated and more detailed baseline information. Reanalysis is expected to occur at that time as required by the National Environmental Policy Act. The impacts predicted here using this baseline are intended only to provide BLM decision-makers with sufficient information to guide their decision on how to manage the resources in the Piceance Basin into the next century.

Committed mitigation measures are all those stipulations, restrictions and requirements that will be imposed on activities on the public lands to protect environmental, socioeconomic or other resource values. They are the mitigation measures that BLM or other agencies are committed to enforcing in managing the public lands, and are therefore assumed for purposes of the Resource Management Plan. The committed mitigation measures are identified in this chapter for each environmental element. Where these measures differ between alternatives as management practices to be implemented for a particular alternative, they are identified in the alternative narratives in Chapter III.

ENVIRONMENTAL CONSEQUENCES

TABLE IV-1

ASSUMPTIONS FOR FEDERAL OIL SHALE LEASING THROUGH THE YEAR 2000, BY ALTERNATIVE

Assumed for (Alternative)[1]	Lease Year	Peak Construction		Full Production			Type of Development [4]
		Year	Employ-ment	Year	bbl/ day	Employ-ment	
OS	1984	1995	1,750	2000	37,000	1,550	Multimineral [2]
OS, OG	1990	2000	1,750	2005	37,000	1,400	Underground
OS, OG, CM	1995	2005	1,750	2010	37,000	1,550	Multimineral [2,3]
OS	1998	2008	1,750	2013	37,000	1,400	Underground
OS, OG, CM, WL	2000	2010	1,750	2015	37,000	1,400	Underground

[1] A total of five potential lease tracts are described in this table. Each line represents the assumptions made for each tract, and are not cumulative. The alternatives in which each of the lease tracts are assumed are indicated by abbreviations in this column. OS = Oil Shale Alternative (five tracts total), OG = Oil and Gas Alternative (three tracts total), WL = Wildlife Alternative (one tract total), CM = Current Management Alternative (two tracts total). The Preferred Alternative is assumed to result in oil shale leasing and development ranging between the Oil and Gas and Current Management Alternatives. Separate assumptions were not made.

[2] In addition to shale oil, some 9,000 tons/day of nahcolite and 2,200 tons/day of dawsonite are assumed to be produced for multimineral development.

[3] In the Oil and Gas Alternative, this multimineral development is assumed to be located outside of the multimineral management priority area.

[4] Given the contraints on leasing for open pit mining under each alternative, it was assumed that it would be unlikely that additional open pit oil shale leasing would occur until after the year 2000. However, where critical impacts from open pit mining could occur, they have been addressed under each environmental element.

All applicable laws and their implementing regulations are assumed as committed mitigation. In addition, for purposes of assumptions in this RMP, the environmental stipulations of the oil shale lease included as Appendix A in the Final Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program (USDI, BLM 1983c) are considered as committed mitigation. These stipulations are currently being implemented and are anticipated to continue in a similar form in the long-term, commercial oil shale leasing program. Numerous specific stipulations and restrictions are also included in the *White River Oil and Gas Umbrella Environmental Assessment* which are all assumed and incorporated by reference. For the Current Management Alternative, the multiple-use recommendations that were incorporated in the applicable White River Management Framework Plan decisions are assumed as they apply to committed mitigation.

In addition to these assumed committed mitigation measures, residual impacts could be mitigated by other methods that BLM is not committed to or are outside the Bureau's authority to enforce. These measures are called uncommitted mitigation and are identified for each environmental element in this chapter, and are summarized at the end of the chapter.

AIR QUALITY

All Alternatives

Certain impacts to the existing air quality in the Piceance Basin and surrounding areas are inevitable under any of the five resource management alternatives. These impacts would be in the form of increased emissions of air pollutants and a resulting increase in the levels of those pollutants in the ambient air. Even without further development of oil shale, oil and gas, coal or other resources on Federal lands, the development of projects already under way and new projects on private lands, would contribute to these impacts.

Pollutants which would be produced include: sulfur dioxide, particulate matter, oxides of nitrogen, carbon monoxide, lead, and ozone. Allowable levels of these pollutants have been set by the U.S. Environmental Protection Agency as well as the State of Colorado. Data on these pollutants are available upon which to base predicted impacts and to plan strategies of committed mitigation measures.

Pollutants which may be emitted, but for which allowable levels have not been set, or for which necessary data does not yet exist for complete evaluation include: vanadium, nickel, zinc, arsenic, sulfur species other than SO_2, and polynuclear aromatic hydrocarbons (Ondov et al 1982). All of these materials are toxic, however, preliminary data indicate that they will be emitted in such small

amounts as to have negligible impacts on the surrounding environment. Research is continuing to characterize these emissions and their potential impacts more definitely.

Other indirect effects from increased pollution levels are possible. These indirect effects are: increased acid precipitation resulting from reaction of sulfur dioxide and nitrogen dioxide in the atmosphere, decreased visibility, and possible effects on sensitive plant or animal species. These indirect effects are of special concern for their potential impacts on nearby national parks, monuments or wilderness areas.

The White River National Forest is currently preparing a Land and Resource Management Plan for the lands east of the Piceance Basin under their jurisdiction. In that plan, all management alternatives provide for continuing the development of an air quality monitoring program in the vicinity of the Flat Tops Wilderness Area. The purpose of this program is to gather baseline data so that deterioration of air quality related values can be determined and quantified, if it occurs. Baseline data is presently being gathered on meteorology, airborne particulates, visibility, lichen conditions and acidity of precipitation. The eventual scope and size of this monitoring program is not known at this time. However, it is anticipated that it will continue, at least at present levels, under all the Forest Service management alternatives (USDA, Forest Service 1983).

The atmosphere has a great capacity to recover from pollution if the sources of emission are removed. Since all the industrial development projects considered in the alternatives deal with finite resources (i.e., oil and gas, oil shale), at some point they will be shut down. Thus in the long-term, the air may be expected to regain its present high quality. Some degradation of air quality will continue due to established urbanization in the area after closure of the oil shale facilities. However, no significant impairment of long-term productivity is predicted. While the air resource itself will not be irretrievable damaged, it is possible that some impacts of increased air pollution may be irreversible. For example, if increased levels of air pollution lead to the loss of a biological species, the loss would be irreversible. Existing studies do not indicate any likelihood of this occurring, but it remains a possibility.

As described in Chapter II, the region is subject to the EPA regulations for Prevention of Significant Deterioration (PSD). These regulations require that all major projects employ the Best Available Control Technology (BACT). BACT requirements specify that each source of pollution within the plant or project must apply that method of pollution control which has been reliably demonstrated to achieve the highest degree of control, taking into account energy, environmental and economic costs. Also, much of the equipment and processes in an oil shale or coal operation will be subject to New Source Performance Standards, which set definite limits to the amounts of pollutants which may be emitted. These requirements, along with the environmental lease stipulations will insure that there will be no conflicts between the RMP and any state, local or other Federal air quality standards, plans or policies. In addition, mitigation as stipulated on coal leases will meet the Office of Surface Mining requirements.

Comparison of Impacts

Significant impacts for all alternatives are possible for sulfur dioxide, particulate matter, visibility and acid deposition. Impacts for the other criteria pollutants, (nitrogen dioxide, carbon monoxide, ozone and lead) are not significant because predicted levels are well below the ambient standards, or in the case of ozone, because predicted increases are not significantly higher than naturally occurring levels (USDI, BLM 1982a, 1983a, 1983b). The following compares these impacts as anticipated for each alternative.

Current Management Alternative

The Current Management Alternative would have impacts for SO_2 and particulates about 30 to 50 percent above the assumed baseline, respectively. Ambient levels could be close to or equal to the allowable short-term increments for class II PSD areas (Piceance Basin), and below the long-term increments. For class I increments in the Flat Tops Wilderness Area, short-term increments (24 hours or less), could be equaled or exceeded, while long-term increments would not be. Visibility could be significantly impacted, by a decrease in general range of visibility, and by plumes of pollution visible from points in the Piceance Basin as well as from the Flat Tops Wilderness Area. Acid deposition could increase for the whole area. This would probably not be significant for the Piceance Basin, where alkaline soils provide good "buffering capacity", but may be significant for the Flat Tops, where some alpine lakes may be vulnerable to acid deposition.

Wildlife Alternative

The Wildlife Alternative would have the minimum impact for all pollutants and all areas covered by

this analysis. Impacts are generally within about 10 percent of the assumed baseline. The ambient concentrations could again be close to or equal to the class II short-term increments. This is due to emissions from assumed baseline sources, not to increases from the Wildlife Alternative sources. Long-term class II increments should not be exceeded. For class I increments, the short-term increment would probably be equaled, while long-term increments would not. Significant impacts to visibility are probable, again due to assumed baseline sources, while impacts from acid deposition in the Flat Tops are possible.

Oil and Gas Alternative

Impacts from the Oil and Gas Alternative are essentially equivalent to those from the Current Management Alternative. The techniques used in this analysis cannot distinguish between these two alternatives.

Oil Shale Alternative

The Oil Shale Alternative carries the heaviest impacts of all the alternatives. Impacts for particulates and SO_2 range from 50 to more than 100 percent over the assumed baseline. Short-term class II increments would almost certainly be exceeded, while long-term (annual) increments would be maintained. The same is true of the class I increments. Significant impacts to visibility, both regional visual range and visible plumes, are most likely to occur under this alternative. Acid deposition effects would also be highest for this alternative.

Analysis of an additional open pit oil shale mine was performed for this alternative to compare differences in predicted impacts. The analysis showed that it would not significantly change the results of the impacts as compared to the other alternatives where only Tract C-a was assumed as an open pit mine. Actual ambient concentrations close to an additional oil shale open pit mine may be significantly different from a scenario with only Tract C-a. However, project specific analysis and sophisticated modeling would be required in order to predict potential pollutant concentrations. Such an analysis would be performed prior to offering such a lease.

Preferred Alternative

Impacts from the Preferred Alternative are essentially equivalent to those of the Current Management and Oil and Gas Alternatives. The techniques used in this analysis cannot distinguish between these three alternatives.

In summary, the alternatives divide themselves into three groups based on the level of air quality impacts. The Wildlife Alternative has the lowest levels of impact, very close to baseline. Ambient standards and PSD increments would most likely be maintained, and visibility and acid deposition effects would be minimized. The Current Management, Oil and Gas, and Preferred Alternatives form the second group. Impacts would be significantly above baseline. National Ambient Air Quality Standards could be maintained, but short-term PSD increments, both class I and class II, could be equalled or exceeded, while long-term increments would be less. Significant impacts to visibility, well above baseline, would most likely occur. Acid deposition effects are difficult to predict, but would be considerably above the baseline and Wildlife Alternative. The Oil Shale Alternative constitutes the third division of impacts. Impacts in all categories could be maximized for this alternative. Again, short-term increments would be imperiled, while long-term increments and standards would be maintained. Impacts to visibility and acid deposition would be maximized.

Carrying Capacity

In a study conducted by Putnam, Hayes and Bartlett, Inc. (1982), a carrying capacity for the air quality of the Piceance and Uintah Basins is referenced in terms of the allowable PSD increments. Results of that study agree with the other studies and EISs referenced here, as well as with the analysis performed for this RMP. Extrapolation from the Putnam, Hayes, and Bartlett study indicates that under present PSD regulations and policy, about 400,000 barrels per day of shale oil could be produced in the Piceance Basin without exceeding allowable PSD increments. The baseline sources assumed for this RMP comprise a projected production rate of 233,400 barrels per day. This leaves an additional production potential of 126,600 barrels per day. If we assume an average production rate for potential future leases of 37,000 barrels per day for each lease, then up to three additional leases could be accommodated in addition to the baseline.

This agrees with the RMP analysis which shows the Current Management, Oil and Gas, and Preferred Alternatives with two or three additional oil shale tracts assumed to be leased over the next 15 years, to be very close to the maximum allowable impacts in terms of PSD increments. The Wildlife Alternative could accommodate an additional two oil shale tracts at a later date over what is proposed and still be within present PSD increments. The Oil Shale Alternative, however, may violate

present PSD requirements and could only be implemented if in the case of a Class I exceedence, the Federal Land Manager is convinced by demonstration that such an exceedence would not significantly degrade Air Quality Related Values (exceedence of Class II PSD standards is not allowed).

It should be noted that the Putnam, Hayes and Bartlett study involves numerous assumptions of the level of development of various projects. The projected carrying capacity should be used strictly as a guideline. Although violations are indicated in the Oil Shale Alternative, site specific modeling would be developed directly from a proposed mine plan and the actual impacts to the PSD increments would then be predicted. Therefore, site specific modeling and monitoring of real air quality impacts from existing projects would be compared and would ultimately determine the level of leasing proposed in the Oil Shale Alternative.

Current experience has shown that PSD increments for SO_2 and particulates are exceeded before adverse impacts to AQRVs are demonstrated, with the exception of visibility in Class I areas in the region. This assumes existing PSD regulations, policy and BACT. As technology improves or if PSD regulations relax, production rates may increase. PSD permits issued by the state would act as an effective limit to development, but not necessarily to leasing.

Description of the Analysis

This analysis draws on several sources. The environmental consequences were developed through application of a *screening model*, as well as by summarizing and extrapolating from the more detailed studies listed in the references (Rio Blanco Oil Shale Co. 1976; Environmental Protection Agency 1983). The screening model consists of equations drawn from the textbook *Air Pollution, Its Origin and Control* by Wark and Warner (1980). Inputs for the model were taken from the studies shown in the reference section, as well as from the baseline assumptions described in the introduction to this Chapter. It must be stressed that because of the conservativeness and lack of sophistication of the screening model used, as well as the lack of project specific inputs, the modeling analysis is very rudimentary, and is not suitable for predicting actual ambient levels of pollutants. It is suitable for projecting relative levels of impact between the different management alternatives being examined. Results of modeling analysis were verified by comparison with predicted impacts from the referenced studies. Statements in this RMP comparing projected ambient concentrations to ambient standards and PSD increments were arrived at by interpolation of the screening model results and the results of the referenced studies.

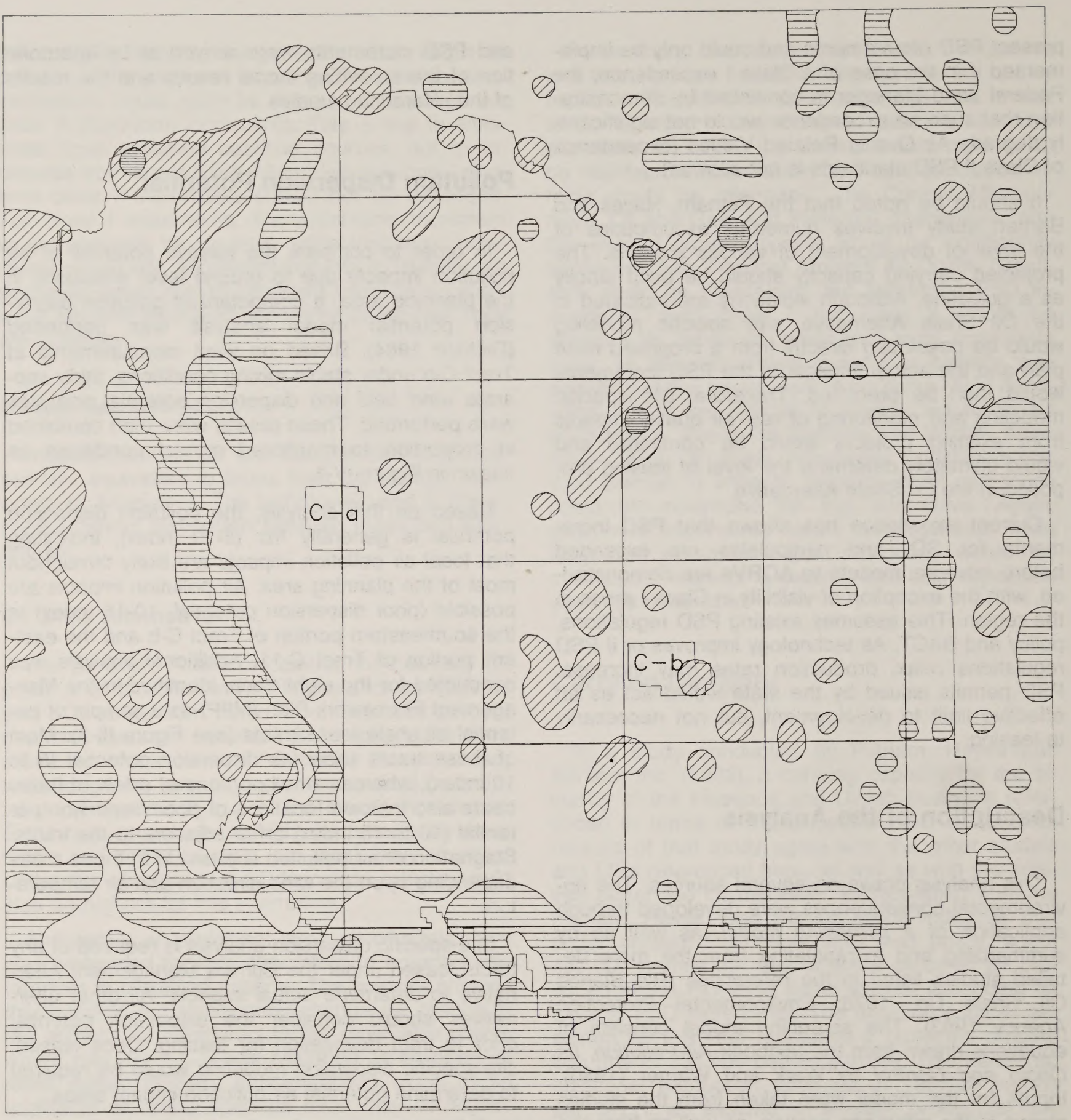
Pollution Dispersion Potential

In order to compare the relative potential of air pollution impacts due to ground level emissions in the planning area, a computerized pollution dispersion potential model analysis was performed (Dietrich 1984). Based on wind measurements at Tract C-b under stable mixing conditions, thirty separate wind field and dispersion potential analyses were performed. These results were then combined in proportion to monitored annual conditions as shown in Figure IV-1.

Based on this analysis, the pollution dispersion potential is generally fair (5-10 index), indicating that local air pollution impacts are likely throughout most of the planning area. Air pollution impacts are possible (poor dispersion potential, 10-15 index) in the southeastern portion of Tract C-b and the eastern portion of Tract C-11. Additional analysis was conducted for the eight tracts identified in the Management Framework Plan (MFP) as a sample of potential oil shale lease tracts (see Figure III-2). Most of these tracts show fair dispersion potential (5 to 10 index), whereas small portions of a few of these tracts also indicate locations of poor dispersion potential (10 to 15 index) on or adjacent to the tracts. Stagnation of air pollution is possible in these areas depending upon the wind direction and air temperature.

Site-specific dispersion analysis is required of any tracts leased under the Current Management Alternative to determine actual impacts. All other alternatives should consider the dispersion potential prior to tract delineation for leasing. Once leased, site-specific dispersion modeling would be required to determine potential air pollution impact areas.

In general, the best pollution dispersion potential is found along the western and southern boundaries of the planning area. The worst pollution dispersion potential is found in specific drainage basins. Future leasing would consider the pollution potential in addition to other resource values prior to tract delineation.



AIR POLLUTION DISPERSION POTENTIAL

Figure IV-1

GEOLOGY AND MINERAL ACTIVITY

Current Management Alternative

Oil Shale

Under this alternative, an estimated 19 to 25.5 billion barrels of shale oil could be produced with 20 to 20.6 billion barrels left unrecovered due to present extraction-retort technology. The unrecovered oil shale could be irretrievably lost due to the unfavorable economics involved in returning to a previously mined area.

Leasing of new tracts would be considered only when existing tracts are developed or a new extraction-retort method is proposed. Higher shale oil recovery rates are possible for future development as technology improves. By delaying development of new tracts, the total resource irretrievably lost may be decreased.

Loss of oil shale resources as a result of development of existing sodium leases and PRLAs is also a possibility. Subsidence caused by underground and in-situ mining methods could disrupt overlying oil shale strata causing mine engineering and safety problems. Lease stipulations within the sodium leases require protection of the oil shale resources.

Conflicts between oil shale and oil and gas development could be expected. A significant amount of oil shale minerals may be irretrievably lost due to prior oil and gas rights of producing leases within the oil shale priority area. Sufficient barrier pillars would have to be left in place to ensure the safety of an existing oil and gas well and the oil shale mine. Oil and gas lease holders may have to be compensated for the irretrievable loss of oil and gas resources to allow the continuance of an oil shale open pit mine. Resolution of those conflicts is the responsibility of the respective lessees and should not constitute a significant impact on the development of either mineral resource.

Oil shale development is regulated by the Mineral Lands Leasing Act of 1920 and in all alternatives it is assumed that development would be guided by stipulations similar to those included in the prototype oil shale leases. Some modifications may be necessary at the time of lease sale. In addition, reclamation activities of the oil shale leases have regulatory requirements set by the Colorado Mined Land Reclamation Board.

Sodium

Presently, sodium mineral activities are limited to five leases totalling 9,680 acres and three PRLAs consisting of 7,157 acres located adjacent to the existing leases. No new leases would be issued until existing leases are developed.

Under this alternative, the possibility exists for significant quantities of nahcolite and dawsonite resources to remain unrecovered if no development on the existing leases takes place. If present leases and/or PRLAs are developed and new leases could also be issued in conjunction with oil shale, an increase in sodium production could be expected. Recovery of sodium resources by conventional underground methods could result in 50 to 80 percent of the total resource irretrievably left in the ground in pillars, barriers and mixed in the overburden. In-situ recovery of nahcolite by solution mining is currently being tested in the basin. Mineral resource recovery may be enhanced by this method, however, surface effects of subsidence are unknown and may increase in likelihood and magnitude.

Oil and Gas

Almost the entire planning area is open to oil and gas exploration and development subject to the stipulations identified in the *White River Resource Area Oil and Gas Umbrella Environmental Assessment*. Oil shale open pit and oil shale underground mining may have the greatest impact on long-term productivity of oil and gas resources. Oil and gas resource recovery may be delayed for the life of an underground oil shale mine or irretrievably lost due to oil shale open pit mining.

Coal surface and coal underground mining is not expected to have significant impacts on the recoverability of oil and gas resources since oil and gas development has priority over coal development. Most mineral conflicts are resolvable by the lessees resulting in no significant resource loss. Other nonmineral conflicts are mitigatable, again resulting in no significant loss of mineral resources.

Development of oil and gas reserves at this time usually results in at least 40 percent of the resource remaining in the ground due to present oil field technology. However, this loss may not be totally irretrievable, depending on whether or not wells have been plugged and fields abandoned. Redrilling wells for 40 percent of the original resource may not be economically feasible. In addition, enhanced recovery methods (secondary and tertiary) may also increase total production and lessen the impact of unrecoverable resources.

Whenever the lessee or operator of a Federal oil and gas lease decides to drill on the leasehold, all proposed drilling operations and related surface disturbing activities must be approved before entry upon the lands involved. Approval will be in accordance with (1) lease stipulations, (2) Title 43 CFR Part 3160, *Onshore Oil and Gas Order No. 1*, and (3) State regulations. In addition, the lessee will be required to meet the committed mitigation measures and stipulations in the *White River Oil and Gas Umbrella Environmental Assessment*.

Coal

Approximately 29,610 acres of the planning area (5.4 percent) are underlain by recoverable coal deposits and have been deemed acceptable for mining. New tracts from this area have not been identified or proposed for leasing. Current standard stipulations governing coal exploration, leasing and development are assumed. These include guidelines developed under the Federal Coal Management Program, the White River Resource Area MFP coal amendment decisions and the Memorandum of Understanding between the Bureau, the former Minerals Management Service and the Office of Surface Mining. Standard and special lease stipulations, NEPA compliance and the approval of a final mine plan are considered committed mitigation.

Conflicts with oil and gas and coal development are a possibility, however, they should be resolvable by the lessees resulting in no significant impact to either resource.

Locatable Minerals

Almost the entire planning area is within an oil shale withdrawal which closes the area to locatable mineral entry. In addition, locatable minerals in economically recoverable quantities are not known to exist within the basin. Locatable minerals development is regulated by existing Federal policies, guidelines and regulations, including the General Mining Law of 1872 (as amended), the Federal Land Policy and Management Act and stipulations for plans of development under the 3800 regulations. Removal of the oil shale withdrawal could also open the Piceance Basin to the provisions of the Multiple Mineral Development Act of 1954 (as amended), which would reserve leasable minerals on valid post-1920 mining claims.

Saleable Minerals

Significant impacts are not expected. Development of saleable minerals would occur as demand requires. Supply is estimated to be adequate to accommodate proposed development activities. However, the total saleable mineral material resource would remain unknown under this alternative. Saleable mineral development is regulated by existing Federal policies, guidelines and regulations. The Colorado Mined Land Reclamation Board also has regulatory requirements on their mine development activities and reclamation.

Geologic Hazards

The potential for geologic hazards such as subsidence and landslides, increases with increased development in the region. All of the alternatives addressed in this plan have the potential for producing impacts from geologic hazards. The magnitude of the impacts is the major difference between the alternatives. The least potential for impacts would occur under the Wildlife Alternative since fewer oil shale leases would be anticipated, ranging up to the maximum potential under the Oil Shale Alternative. Prudent mining and effective lease administration could avoid and minimize the effects of geologic hazards.

Impacts due to the subsidence from underground mine methods could include topographic modification, destruction of surface facilities, restriction of future land uses within underground mine areas, disruption of overlying geologic strata, unsafe mine conditions, aquifer communication, diversion of surface water and destruction of cultural and paleontological resources. The effects of subsidence are mitigated through lease and mine plan stipulations on an individual project basis. Stipulations to control subsidence would also require subsidence monitoring to evaluate the effectiveness of subsidence stipulations within the mine plan.

Landslides and other types of mass wasting movement could increase with increased development, especially during construction activities and within surface mine, open pit mine and spoil pile disposal areas.

Wildlife Alternative

Oil Shale

This alternative would reduce the total potential oil shale production compared to the Current Management Alternative. Oil shale development activities would be restricted to the existing tracts (C-a, C-b), proposed Tract C-11 or C-18 and no more than one additional tract every five years. No new surface or open pit mines would be allowed and location of any new tracts would be restricted to

areas compatible with renewable resources (see Volume 2, Map Addendum).

Restricting oil shale development to this level would result in the short-term loss of shale oil production. Nation wide energy requirements might not be met under this alternative. However, by delaying development, new technology may increase the overall long-term productivity.

Production of some additional oil shale resources may be precluded by the designation of the 12 Special Management Areas, involving 23,965 acres, depending on future oil shale development of Federal and private lands.

The irretrievable loss of oil shale resources due to conflicts with oil and gas development would be the same as that described in the Current Management Alternative.

Sodium

No new sodium-only leases would be issued. All sodium recovery would be concurrent with oil shale development. Impacts to sodium production would be directly related to the potential for oil shale mineral development and may result in the long-term loss of production of sodium minerals.

Oil and Gas

Special Management Areas, additional stipulations, especially No Surface Occupancy and more available renewable resource priority lands could result in a decrease in oil and gas production. In addition, impacts to the oil and gas resources by other mineral development would be the same as those described in the Current Management Alternative with the exception of coal surface mining which would not be allowed under this alternative. Conflicts with other minerals are possible, but most should be resolved by the lessees resulting in no significant impacts.

Coal

Impacts would be similar to those described in the Current Management Alternative. Since the coal resource in the planning area is presently not believed to be recoverable by surface mining techniques, it is unlikely that restriction of surface mining will affect the coal resource.

Locatable Minerals

No impacts anticipated.

Saleable Minerals

Impacts to saleable minerals would be similar to those described in the Current Management Alternative.

Geologic Hazards

Impacts from geologic hazards associated with development would be similar to those described in the Current Management Alternative.

Oil and Gas Alternative

Oil Shale

Fewer lands compatible with oil shale development are available for leasing in this alternative than in the Wildlife Alternative. No oil shale leasing would occur in the multimineral zone (depositional center of the basin), saving the thickest and richest oil shale, nahcolite and dawsonite resources until recovery technology has been proven. Short-term oil shale recovery could be greater than either the Current Management or Wildlife Alternatives depending on industry demand. Amount of unrecoverable resource could also increase, especially in underground mineable areas. Indefinite oil shale production loss is also a possibility from the multimineral zone. However, delaying development until recovery technology improves may increase long-term productivity. Loss of oil shale resources, due to subsidence, is also a possibility where sodium-only leases are developed.

Recovery of significant amounts of oil shale resources could be delayed for the life of the oil and gas field where KGSs and tight gas formations overlap with open pit mineable areas. Impacts to the long-term productivity of oil shale would be of the same type described in the Current Management Alternative only to a much greater extent. This is due to the much larger priority area of oil and gas resources.

Additional loss of production from three designated Special Management Areas (5,745 acres) is possible, but should not be significant.

Sodium

Impacts should be similar to those described in the Current Management Alternative.

Oil and Gas

This alternative would offer more oil and gas management priority lands than any other alternative. A large increase in oil and gas production is possible depending on market demands. This short-term increase in production could result in larger long-term losses of unrecoverable resource due to present oil field production technology as described in the Current Management Alternative.

Conflicts with other minerals, especially oil shale, could increase because of increased priority lands and oil and gas stipulations placed in all new oil shale lease agreements. Most conflicts should be resolvable, however, conflicts between oil and gas and open pit mineable oil shale could result in a significant loss of oil shale for the life of the oil or gas field. The irretrievable loss of oil and gas resources could increase over that described in the Current Management Alternative since more oil shale open pit development would be allowed; provided open pit development occurred prior to oil and gas field development.

Coal

Impacts would be similar to those described in the Current Management Alternative.

Locatable Minerals

No impacts anticipated.

Saleable Minerals

Demand for saleable minerals could increase dramatically. Supply of saleable minerals is estimated to be adequate. A saleable mineral inventory would be initiated to find the best sand and gravel resources. Development would occur as demand arises. Conflicts with other resources would be mitigated or avoided if necessary.

Geologic Hazards

Impacts from geologic hazards associated with development would be similar to those described in the Current Management Alternative.

Oil Shale Alternative

Oil Shale

This alternative would offer the largest oil shale management priority area and potentially the greatest short-term oil shale resource recovery. The amount of resources considered unrecoverable by present mining technology would also increase dramatically. Resources that could be recovered in the future due to improved extraction-retort technology may be irretrievably lost.

The potential for significant oil shale/oil and gas conflict is greatest under this alternative. Most problems should still be resolvable, however, the large oil shale management priority area coupled with the oil shale stipulation placed in all new oil and gas lease agreements would decrease the likelihood of oil shale resources remaining undeveloped.

Sodium

Impacts would be similar to those described in the Wildlife Alternative.

Oil and Gas

Oil and gas management priority areas would remain extensive under this alternative, however, stipulations allowing oil shale development would be included in all new or reissued oil or gas leases within the oil shale leasing area and will increase the likelihood of oil and gas resources remaining undeveloped.

The possibility of significant irretrievable loss of oil and gas production, especially in open pit oil shale mineable areas is greater in this alternative than the Current or Preferred Alternatives

Coal

Impacts would be similar to those described in the Current Management Alternative.

Locatable Minerals

No impacts expected.

Saleable Minerals

Impacts would be similar to those described in the Oil and Gas Alternative.

Geologic Hazards

The greatest potential for impacts from geologic hazards could occur under this alternative. Impacts would be similar to those described in the Current Management Alternative.

Preferred Alternative

Oil Shale

Impacts would be similar to those described in Oil and Gas Alternative, except no additional impacts would be anticipated from sodium-only leasing.

Sodium, Oil and Gas, Coal

Impacts would be similar to those described in the Current Management Alternative.

Locatable Minerals

No impact expected.

Saleable Minerals

Impacts would be similar to those described in the Oil and Gas Alternative.

Geologic Hazards

Impacts would be similar to those described in the Current Management Alternative.

TOPOGRAPHY

Current Management

Significant unavoidable impacts to the existing topography of the basin could be expected from oil shale open pit and coal surface mine development and to a lesser extent underground oil shale and coal mining.

Oil shale open pit mining would result in a disposal pile of overburden and spent shale material somewhere in the vicinity of Tract C-a as a result of the initial cut of the open pit on Tract C-a. This material may become a permanent feature of the basin and would be shaped to conform as much as practical to that of the existing topography. In addition, the advanced bench face of the pit will be left exposed and probably would not be shaped to conform to the existing topography.

Coal surface mine development would have the same impacts as that of oil shale open pit mining, however, the shallower depths of mining would allow the initial overburden material and the advanced bench face to be conformed more closely to the topography of the existing environment.

Underground oil shale and coal mining could result in significant subsidence and would depend on the mining technique used.

Mineral development and planned subsidence from underground coal mining could result in increased surface area as a result of slope modification and reclamation. However, any increase in acreage due to slope modification would be offset by the unreclaimed open pit mine faces.

Wildlife Alternative

Significant unavoidable impacts modifying the existing topography of the basin in this alternative would be the least of all the alternatives. This would be due to the fact that coal surface mining and new open pit oil shale mining would not be permitted.

Oil and Gas Alternative

Unavoidable impacts to the existing topography would be greater in this alternative than the Current Management Alternative. The potential impacts to topography would be the same as those described in the Current Management Alternative with the potential addition of oil shale open pit mining north of Tract C-a. As a result, this alternative could result in additional permanent overburden disposal piles and additional open pit mine faces. The open pit mine faces would probably not be modified to conform with the existing topography. Impacts caused by coal development, however, would be less than the Current Management Alternative as a result of not allowing coal surface mining.

Oil Shale Alternative

Unavoidable impacts to topography would be greater in this alternative than the Oil and Gas Alternative. The potential impacts would be similar to

those described in the Oil and Gas Alternative; however, the potential for coal surface mining makes this alternative more impactive to the existing topography.

Preferred Alternative

Unavoidable impacts caused by this alternative would be similar to those described in the Oil and Gas Alternative.

FLOODPLAINS AND ALLUVIAL VALLEYS

Current Management Alternatives

Major impacts to alluvial valleys and floodplains would be from the physical modification of the natural flow conditions and alteration of the water quantity and quality of these designated areas as caused by mineral development activities.

Alluvial valleys may be affected in two ways: 1) groundwater system disruption of water quantity and quality caused by mine development, and 2) surface disturbing activities such as spent shale disposal placement and topsoil borrow areas for reclamation.

Floodplains may be affected by energy and mineral development in two ways: 1) by the direct physical modification of the floodplain proper, which would change the natural and beneficial water course network and flow, and 2) disruption of natural water flow to the receiving floodplains, which would modify the existing water quantity and quality.

Oil shale open pit and coal surface mining would have the greatest impacts to alluvial valleys and floodplains.

Floodplains are managed by the policies and guidelines set forth in Executive Order #11988 which require mitigation and/or avoidance of floodplains by mineral development activities. The Bureau's Coal Unsuitability Criterion #16 provides for additional protection or mitigation of floodplains as affected by coal mining activities. Evaluation of floodplains on a site-specific basis will be conducted in mineral resource areas prior to leasing.

Designated alluvial valleys significant to agricultural practices are excluded from disturbances related to coal mining activities under the provisions of the Surface Mining Control and Reclamation Act of 1977. The Bureau's Coal Unsuitability Criterion #19 provides additional protection or mitigation of alluvial valley floors as affected by coal mining activities. With the exception of coal, alluvial valleys are not protected from other forms of mineral development. For coal lands, however, alluvial valley floors will be determined prior to leasing and mitigation, avoidance or exemption will be stipulated as appropriate.

Wildlife Alternative

Under the wildlife alternative, impacts from energy and mineral development would be similar to the Current Management Alternative, although the magnitude of potential impacts would be less. Fewer oil shale tracts would be leased and no new open pit tracts would be permitted. Coal development would be restricted to only underground mining.

Oil and Gas Alternative

Under the Oil and Gas Alternative, impacts from energy and mineral development would be similar to the Current Management Alternative, although the magnitude of potential impacts may be greater.

Additional oil shale leasing could include an additional oil shale open pit mine. Development of oil and gas under this alternative would increase to its fullest potential, and coal development would be in those areas favored for underground methods.

Oil Shale Alternative

Under the Oil Shale Alternative, impacts from energy and mineral development would be the greatest both in quantity of potential impacts and in the magnitude of those impacts. The greatest level of oil shale leasing would occur in this alternative. The potential for open pit oil shale mining would be maximized and coal surface mining would be allowed, potentially resulting in the greatest impacts to floodplains and alluvial valleys.

Preferred Alternative

Under the Preferred Alternative impacts to alluvial valleys and floodplains would be similar to those described in the Oil and Gas Alternative.

AGRICULTURAL LANDS

No significant impacts to agricultural lands are anticipated under the Current Management, Wildlife and Preferred Alternatives. The environmental consequences described below should be considered as having the potential for occurring on prime farmland and irrigated pasture land and hayland of statewide importance.

Oil and Gas Alternative

Intensive development of oil and gas in the planning area will result in the construction of access roads, pipelines and associated utilities. The impact to agricultural lands will occur through the loss of acreage in production, primarily along Piceance Creek.

Oil Shale Alternative

The intensive development of oil shale could affect the water quality and quantity for use on agricultural lands. The effect is unknown since large scale development has not yet occurred and the level of potential oil shale development is unknown. However, if water quality or quantity is lowered, agricultural production may be abandoned.

Urban development would result in a permanent loss of agricultural lands. This could be a significant impact due to the level of population growth predicted in this alternative. Although it can not be determined at this time, urban development in Mesa County could impact orchard lands. Unless they are protected by local law or permit, further loss of orchard lands could significantly impact the Colorado fruit industry.

SOILS

All Alternatives

The development of five existing sodium leases and three Preference Right Lease Applications (PRLAs) if leased, could adversely affect the soil productivity and stability on an undetermined acreage during the soil removal and stripping process, until successful reclamation is achieved.

Underground coal development would be allowed on 29,610 acres, but should create only minimal surface disturbances. Surface mining of coal could significantly impact soil productivity and stability on 24,635 acres.

The impacts from the development of saleable minerals would occur in scattered locations throughout the planning area in all alternatives. These locations occurs on dry harsh sites with low reclamation potential which would decrease the soil productivity as a result of disturbances.

The affect of livestock and wild horse grazing will have very similar impacts in all alternatives. The impact is generally considered slight. However, in heavy use areas water erosion could occur. Soil compaction could reduce moisture infiltration, increase runoff and accelerate erosion. Intensive livestock management practices and vegetation manipulations may cause short-term accelerated erosion losses, but would ultimately benefit the soil resource over the long-term. Similar impacts would result from wildlife habitat improvement projects.

The development of a Fire Management Plan should not have any long-term adverse impacts on the soil resource. Natural fires perpetuate and increase vigor of many plant communities, especially the browse and grass species which are important for soil stabilization. The construction of dozer-built fire lines during fire suppression causes the longest lasting effects on soils as a result of surface disturbance.

Forest product sales generally have only slight impacts on the soil resource. Fuelwood sales are often beneficial in releasing the grass understory which aids soil stabilization. However, sawtimber sales generally occur on steep slopes which may tend to accelerate soil erosion on skid trails, and also increase the potential for mass wasting and slope failure following harvest.

The total surface acres disturbed by oil shale and oil and gas exploration and development will differ in each alternative. The construction of facilities, roads, pipelines and mining disturbances would affect an undetermined acreage. The total cumulative surface disturbances associated with mineral development will depend on the location, number and type of projects developed. The impacts to the soil resource would result from soil removal, stockpiling and subsequent redistribution during reclamation.

The soil forming process would be interrupted with subsequent changes in soil biological activities. This would result in the loss of the natural soil integrity, and the creation of new soils from surface mining disturbances. This would cause the alteration of soil horizons, structure, texture, permeabil-

ity, infiltration rates, effective rooting depths, parent materials, soil microclimates and the disruption of the nutrient and energy cycling. All this would directly affect the revegetation potential and subsequent soil productivity.

Soil erosion losses would occur as a result of construction activities especially on steep slopes. A major concern would be to stabilize the soil material from erosion until sufficient vegetation cover could be established. Seasonal wind erosion would perhaps have the greatest impacts during the reclamation process in the dry summer months. Water erosion would become a problem primarily during spring runoff at which time the soil is saturated and following intense summer showers. Soil erosion may significantly increase the sediment transport and salt loading in the White River and consequently the Colorado River. Measures to control runoff and correct the loss of natural wind sheltering should be required during vegetation establishment.

During the soil stripping process, topsoil should be segregated from the subsoil to maintain fertility. Stockpiling of the soil material during the construction activities and prior to reclamation would cause a loss of organic matter, nitrogen, phosphorous and valuable soil microorganisms (Industrial Resources, Inc. 1983). Soil microbial activity is expected to decrease within the stockpile, causing a decrease in soil productivity (Klein et al 1982). In addition, during topsoil removal, subsoil and some deeper materials could be inadvertently intermixed with the topsoil, changing the initial soil textures and structure. The intermixing, as well as stockpiling, may result in lower soil fertility and reduction of relative productive capacity. The effects can be reduced by implementing proper mitigation techniques and reclamation practices. Fertilization and inoculation of essential microorganisms is recommended to restore fertility in the soil.

The amount of soil for reclamation is often limited due to the shallow layer of topsoil naturally present in much of the planning area, the large content of coarse fragments, and salinity. Compaction of the soil would result from handling and heavy equipment traffic which would reduce the volume of soil material available for reclamation.

Suitable substrate and overburden may often be used for subsoil material. Mitigation which confines the major surface disturbing activities to the more suitable soils and substratum would minimize the potential for structure failures and soil slumpages, and would enhance the opportunity for successful reclamation. Unsuccessful reclamation of the disturbed areas due to poor reclamation potential, inadequate reclamation techniques and harsh climatic conditions would result in a long-term loss of soil productivity.

Current Management Alternative

Under the Current Management Alternative the quantity of surface disturbance occurring would be greater than the Preferred and Wildlife Alternatives, but less than in the Oil and Gas and Oil Shale Alternatives. Implementation of the Current Management Alternative would continue to improve the quality of the soil resource.

To date, oil and gas activity has caused the largest acreage of surface disturbance in the planning area and oil shale presently ranks second. However, potential open pit mine development would cause significant impacts to the soil resource. Impacts from oil shale, and oil and gas development have been described in the All Alternatives section.

Wildlife Alternative

Implementation of this alternative would result in the least amount of surface disturbance when compared to all other alternatives. The Wildlife Alternative would place more stringent mitigation requirements on all surface disturbing activities than presently exist to maximize the productivity of the soil resource. Implementation of this alternative would reduce total surface disturbance on productive and fragile soils. With increasing productivity, the soil loss and sediment transport to the White River would lessen.

Oil and Gas Alternative

This alternative places a very low emphasis on the soil resource, only the Oil Shale Alternative would permit more surface disturbing activities. The primary impacts would consist of surface disturbances resulting from expanded oil and gas exploration and development. The increase in road and pipeline construction would significantly increase soil erosion losses over the present levels and increase the potential for mass wasting and landslide activity.

Oil Shale Alternative

The quantity of surface disturbing activities would be greatest under this alternative, when compared to all other alternatives. Long-term impacts to the soil productivity and stability would occur due to open pit mining and surface disposal of retorted shale. The Final Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program (USDI, BLM 1983c) should be referenced for a complete description of soil impacts and necessary reclamation associated with disposal of spent shale. Impacts to soils would also result from pipeline construction, development of transportation routes and community expansion.

Soil productivity would be affected in various ways. The most significant loss would be from the direct removal of surface and subsurface soils by mining activities. The loss of vegetation cover from mining activity would accelerate wind and water erosion potential. Development of transportation systems and urban areas would constitute a long-term commitment of the soil resource.

Disturbance to fragile soils would accelerate their already high erosion rates. Unless successful reclamation is accomplished, accelerated erosion as a result of disturbance could cause a permanent reduction in the productive potential of these soils. This impact is not quantifiable due to the unknown rate of the development and the amount of land committed to open pit mining and facility sites.

Preferred Alternative

The quantity of surface disturbances and loss of soil productivity and stability would be greater than in the Wildlife Alternative, but less than in the Current Management, Oil and Gas, and Oil Shale Alternatives. The soil productivity and stability should improve by avoiding erosive, saline, and steep slopes wherever possible and through application and enforcement of reclamation measures on surface disturbing projects. Through implementation of an accelerated road maintenance program and adequate provisions for drainage and seasonal road closures, soil loss by water erosion and offsite impacts should lessen.

The greatest amount of road damage occurs from recreation use during hunting season. The impact to the soil resource from recreation activities should lessen through the enforcement of seasonal and permanent road closures, and improved road design and maintenance.

The impacts from oil and gas activity would be very similar to those described in the Current Management Alternative.

The use of designated utility corridors should benefit the soil resource by confining surface disturbances to the more stable sites with favorable reclamation potentials.

HYDROLOGY

The following discussion assumes the committed mitigation measures described below for all alternatives.

Public and private water rights will have to be preserved and protected from degradation of water quantity and quality caused by impacts related to energy and mineral development. Committed mitigation to protect water resources is provided by both Federal and state laws and regulations. Standard Bureau regulations as described in *Surface Operating Standards for Oil and Gas Exploration and Development* are the primary source of mitigating measures. The following Federal laws and standards are applicable:

1. Federal Water Pollution Control Act of 1972 (PL 92-500);
2. Surface Mining Control and Reclamation Act (PL 95-87);
3. Resource Conservation and Recovery Act (PL 94-580);
4. Safe Drinking Water Act of 1977 as amended (PL 93-523);
5. Colorado River Basin Salinity Control Forum Standards;
6. Clean Water Act of 1977;
7. Floodplain Management Executive Order No. 11988 of 1977;
8. Federal Land Policy and Management Act of 1976;
9. Public Rangelands Improvement Act;
10. Water Resources Development Act;
11. Executive Order No. 11514;
12. Classification and Multiple Use Act of 1981.

In addition, the State of Colorado has adopted water quality standards and effluent limitations. They include basic standards that apply to all State waters for both surface and groundwater, and standards which apply to specific waters. Specific water quality standards which apply to the planning

area are identified in the Colorado West Area 208 Plan.

Any water discharged on the surface by any industry is controlled by the State of Colorado's National Pollutant Discharge Elimination System (NPDES) permits which are issued in accordance with the Classification and Numeric Standards, Colorado River Basin. The Classification and Numeric Standards identify allowable concentrations of various water quality parameters to specific stream and water body segments. The NPDES permits are issued on a project-by-project basis, setting discharge limits for water quality parameters in an effort to maintain existing water quality. The NPDES also can allow temporary *Variances* to exceed the water quality parameter limits specified in the stream and water body classifications. Discharges from several projects (although each is discharging within NPDES permitted levels) could cumulatively exceed the minimum state standards for water quality. Currently, the level, number and types of projects that could be allowed before the pollutant carrying capacity of these streams is reached is unknown, but most likely to occur during low flow periods. The Classification and Numeric Standards, Colorado River Basin and the extent to which *Variances* are allowed by the State of Colorado with the NPDES permits, will determine the cumulative impacts of pollutants upon these stream segments and will establish a critical carrying capacity for mineral development as it relates to water quality in the Piceance Basin.

Colorado has also adopted an *Antidegradation Policy* which applies to both surface and groundwaters. This policy requires that state waters be maintained at existing quality unless it can be demonstrated that a change is necessary. Groundwater quality standards are presently being set on a case-by-case project basis by the State of Colorado Department of Health based on recommendations made by EPA. Other committed mitigation includes compliance with Office of Surface Mining regulations for coal leasing, State Water Quality Standards and U.S. Army Corps of Engineers, Section 404 permit requirements.

Current Management

Water Quantity

Most of the impacts to water resources under the Current Management Alternative would be from energy and mineral development. Under this alternative, an estimated 169,400 barrels per day of shale oil could be produced from Federal leases in the Piceance Basin with present technology. Development at this level could cause a reduction in flow in the White River of approximately 6.7 percent (27,110 acre-feet) annually at the confluence with the Green River. This assumes a baseline flow of 450,000 acre-feet annually for the White River. Use of groundwater as a water source for oil shale development would require 16,000 acre-ft/yr for a 100,000 barrel per day industry. Because of the relationship between the bedrock aquifer and the stream system in the Piceance Basin (Weeks and Welder 1974); the use of groundwater for shale oil production may be considered a depletion of the White River just as Piceance or Yellow Creek water would be. Reductions in flow of the White River at these levels may be considered as insignificant. However, portions or all of this water may be irreversibly lost to agriculture over the short-term.

Several private oil shale tracts are located adjacent to the planning area to the south. These tracts could produce an estimated 138,000 bbls/day of shale oil requiring an additional estimated 22,000 acre-feet of water. Although these tracts are contained in the Colorado River surface drainage system, the groundwater aquifer system appears to be in hydraulic connection with groundwater in the White River Basin. These tracts, coupled with the tracts in the Piceance Basin, could adversely affect the overall hydrologic system and in the White River Basin. Water wells and springs developed for oil shale production along the Colorado-White River watershed divide (on the Roan Plateau) could affect water rights, livestock grazing, water quantities and wildlife usage.

Underground oil shale and sodium mining has the potential for creating the greatest impacts to the aquifer system in the planning area. An increase in aquifer mixing would occur as a result of shaft and mine dewatering and could change the local direction of groundwater flow in the aquifer systems.

Any springs or wells which derive their water source from the bedrock aquifer system within the oil shale mineral development areas could also be affected by mine dewatering. Estimated consumptive water use for modified in-situ retorting could add approximately two barrels of water per barrel of shale oil to the previously estimated water usage rates (Lewin and Associates 1982) of four barrels per barrel of shale oil.

Quantities of groundwater in the basin would not necessarily be a limiting factor to mineral development. Estimates of total groundwater in storage range from 10 to 25 million acre feet. The amount of groundwater available, however, would be affected by the location of oil shale lease tracts within the basin and their proximity to one another. This could adversely affect the water production rates,

reinjection rates and dewatering rates between tracts.

The processing of oil shale and the development of an oil shale industry may increase surface water diversions from the White River and thus reduce the available quantity of surface water in the White River.

The State of Utah needs a minimum quantity of water during specific times of the year to provide sufficient water for spawning and habitat for endangered fish species below the White River dam project. The states of Colorado and Utah presently have not established a minimum low flow quantity for the White River. Neither is there an agreement between these states to guarantee water flow from the White River to Utah. This could present problems in the future if the quantity of water in the White River is reduced below the minimum flows necessary to support the endangered fish species in Utah.

Oil and gas development occurs throughout the entire planning area. Exploration and development of oil and gas wells could dry up nearby springs. However, if any wells encounter water-bearing zones, these wells could provide new sources of water.

Water required for each well drilled is highly variable, dependent upon size of the hole, type of drilling fluid or mud and water encountered downhole. On a rough average approximately 1.8 to 2.8 acre-feet of water is needed to drill the 8,000 to 12,000 foot depth of the average hole.

Coal development could impact water quantity on site and to downstream receiving waters. Subsidence could create and/or terminate existing communications with perennial streams, springs, wells or aquifer systems on the coal tracts.

Water Quality

In-situ retorting of shale oil has the potential for creating the greatest impacts to the aquifer system in the planning area. These impacts include contamination from aquifer mixing and leaching of spent shale within flooded retorts. In-situ leachates carried by groundwater may in time discharge into Piceance and Yellow Creeks, causing the quality of these streams to deteriorate. Leaching of surface spent shale spoil piles into groundwater system could also degrade the groundwater or surface water quality. These waters contain high levels of many inorganic and organic constituents.

Sodium leasing under this alternative would be limited to the five leases and three Preference Right Lease Applications in the planning area. Limited information is currently available on water quality problems associated with the recovery of sodium and aluminum from nahcolite and dawsonite. The recovery of sodium minerals could be accomplished by a leaching process. Development would take place in the high resistivity zone in the central portion of the planning area. This high resistivity zone is located in the lower part of the Parachute Creek Member of the Green River Formation and contains a considerable resource of rich oil shale beds. Extraction of nahcolite and dawsonite could present major impacts to the aquifer system.

By creating voids in this zone from solution mining, associated subsidence and/or fracturing of this area may cause intermixing of aquifers and degradation of the lower aquifer which contains substantially higher quality water than the resistivity zone. Increased communication between these beds could decrease water quality to both Piceance and Yellow Creeks; thus affecting the quality of irrigation water, livestock and domestic water supplies and the aquatic regime of these streams. These impacts would be considered irreversible.

If water diversions occur to the White River for the processing and development of the oil shale or sodium resources; increases in salinity in the Colorado River system downstream could be expected. The Bureau of Reclamation developed the Colorado River Simulation Model to predict the change in salinity concentrations at Imperial Dam due to various large scale projects. The model analyzes water flow and salt loads as variables which are used to estimate the salinity impacts. Baseline conditions, parameters and relationships established in this model for anticipated salinity increases from additional development can be found in "Quality of Water in the Colorado River Basin", Progress Report No. 11 (USDI, Bureau of Reclamation 1983). Salinity changes are measured and described in the model as a function of the salt load above Imperial Dam. Under the Current Management Alternative, salinity at Imperial Dam would increase approximately 1.73 milligrams per liter (mg/l).

Any increases of salinity in the Colorado River are considered significant with respect to agriculture, public health, recreational uses, fisheries and economics. A current value of $54.00 per ton of salinity increase at Imperial Dam takes into account the economic cost for desalinization and agriculture impacts. The Current Management Alternative would result in an estimated $934,200 cost increase in necessary desalinization treatment due to anticipated increases in salinity concentrations.

Numerical salinity standards were developed by the Colorado River Basin Salinity Control Forum as a result of the enactment of the Federal Water Pollution Control Act (FWPCA) of 1972, as amended.

The standards call for maintenance of flow-weighted average total dissolved solids (TDS) concentration of 723 mg/l below Hoover Dam, 747 mg/l below Parker Dam and 879 mg/l below Imperial Dam. In an effort to maintain these levels of TDS, these standards are implemented through the National Pollutant Discharge Elimination System (NPDES) permitting authority pursuant to the FWPCA and the Colorado Water Quality Control Act of 1973. The standard simply states "the objective for discharge shall be a no-salt return policy whenever practical" and applies to all mine discharge waters.

Presently the State of Colorado has established an allowable threshold for salinity concentrations. The state policy only requires salinity reductions to a demonstrable, "practical" level. Salinity concentrations, therefore are not in themselves considered a threshold to restrict mineral development in the Piceance Basin.

In addition to salinity concentrations, the NPDES permits set limits in discharge waters for other water quality parameters in accordance with the Classification and Numeric Standards, Colorado River Basin which includes the White River drainage and all tributaries or standing bodies of water associated with that river. The Classifications identify the beneficial uses of the water as High Quality Waters, Recreational, Aquatic Life, Water Supply and Agricultural. The numeric standards are assigned to determine allowable concentrations of various water quality parameters to specific stream and water body segments. The Classification and Numeric Standards may set a threshold to restrict mineral development in the Piceance Basin.

Oil and gas development occurs throughout the entire planning area. Although the areal extent of each oil or gas pad or site is quite small in acreage, cumulative effects of all sites with respect to erosion, sediment transport, excavation and road building can present a significant impact to receiving waters. Sensitive watersheds may need to be identified under watershed management plans to protect these areas and ensure minimal impacts are created by oil and gas roads, pads and flowlines. Products from oil and gas drilling operations (drill muds, fluids, spills and surface runoff) eventually enter groundwater and stream systems and add to the overall reduction of water quality from energy and mineral development. In addition, improper drilling, completion or abandonment of oil and gas wells could degrade the water quality of nearby springs and could impact the quality of the groundwater systems by mixing of aquifer waters.

Under the Current Management Alternative, coal development could impact both surface and subsurface water quality on site and downstream receiving waters. Impacts could include aquifer mixing, channel modifications, subsidence effects, salt loading, and increased sediment yields which would result in the general lowering of surface and subsurface water quality.

Coal spoils would allow aquifer mixing and contact of differing geochemical properties other than the original undisturbed strata of the surrounding hydrologic system. Leaching could occur and contaminate ground or surface water. Modifications to drainages could remove the natural and beneficial factors of stream channels; thereby increasing sediment loads and decreasing stream quality.

Wildlife Alternative

Water Quantity

Under the Wildlife Alternative, impacts from oil shale development would be similar to the Current Management Alternative, although the magnitude of impacts would be the least of all alternatives. Under this alternative only some 132,400 bbls/day of shale oil are assumed to be produced from tracts in the basin. This would require a total of 21,190 acre-feet of water for oil shale production; 5,920 acre-feet less than the Current Management Alternative. This would result in a reduction of 5.2 percent of the flow of the White River at the confluence with the Green River.

Water Quality

Open pit oil shale mining would not be allowed with the exception of Tract C-a. This alternative could, therefore, have the least disruptive impact upon the groundwater system of any alternative. Intermixing of the aquifers and lowering of the overall water quality would be restricted to areas of underground oil shale mining and would thus have the least impact upon water quality of any alternative.

Sodium leasing would not be allowed under this alternative unless developed concurrently with oil shale. Impacts from sodium development would be the same as those described under the Current Management Alternative, for sodium and oil shale combined.

Under this alternative, salinity at Imperial Dam would increase approximately 1.35 mg/l. This could represent a cost of approximately $729,000 for necessary desalinization treatment at Imperial Dam.

Special Management Areas and additional stipulations could limit coal, oil shale, and oil and gas production, thus lowering the magnitude of impacts

identified in the Current Management Alternative. Sensitive watersheds may be identified through watershed management plans in order to protect the Special Management Areas designated under this alternative.

Coal development would be restricted to underground mining methods; thus decreasing the amount of surface disturbance. All impacts identified under the Current Management Alternative would apply to the Wildlife Alternative for coal development. Only those impacts associated with surface disturbance would be reduced.

Oil and Gas Alternative

Water Quantity

Under the Oil and Gas Alternative, impacts from oil shale development would be similar to the Current Management Alternative, although the magnitude of impacts would be greater. One additional oil shale tract would be leased, over and beyond the level assumed by the Current Management Alternative. This would put the assumed production of shale oil at 206,400 bbls/day in the Piceance Basin. An additional 5,920 acre-feet of water would be needed for production, or a total of 33,030 acre-feet needed for the production of oil shale under this alternative. This water usage would amount to an 8.2 percent reduction in the annual flow of the White River at the confluence with the Green River.

Water Quality

Oil shale open pit mining would be accommodated to a greater extent than the Current Management Alternative and would therefore, have a greater disruptive impact upon the groundwater system in the planning area than the Current Management or Wildlife Alternative. Intermixing of the aquifers and the resultant lowering of the overall water quality would be more extensive than in the Current Management or Wildlife Alternative.

Sodium leasing would not occur under this alternative until all existing sodium leases were developed, therefore, impacts from sodium development would be the same as those under the Current Management Alternative.

Under this alternative, salinity at Imperial Dam could increase by approximately 2.12 mg/l. This salinity increase could represent a cost of approximately $1,144,800 for necessary desalinization treatment at Imperial Dam. Salinity impacts based on the above figures could be expected to be greater than either the Current Management, Wildlife or Preferred Alternatives.

Development of oil and gas under the Oil and Gas Alternative would increase to its fullest potential. This could dictate the necessity to identify sensitive watersheds in these areas of development and create watershed management plans for improving these areas with intensive management practices. This would allow for increased areas of oil and gas production while controlling sediment transport and degradation of the water quality associated with development.

Coal development would be in those areas favored for underground methods, therefore impacts would be similar to those described in the Wildlife Alternative.

Oil Shale Alternative

Water Quantity

Under the Oil Shale Alternative, impacts from oil shale development would be the greatest both in quantity of impacts and in the magnitude of those impacts. Three additional oil shale tracts would be leased over and beyond the level assumed in the Current Management Alternative. This would increase the assumed production level of shale oil to 317,400 bbls/day in the Piceance Basin. An additional 17,760 acre-feet of water will be needed for the additional oil shale production or a total of 44,850 acre-feet. The 44,850 acre-feet is approximately eleven percent of the surface flow of the White River annually. This quantity may prove to be a significant reduction in flow to the White River.

Water Quality

Oil shale open pit mining could occur to the greatest extent of all the other alternatives and could cause the most impact to the groundwater system. Intermixing of the aquifers lowering the overall water quality would be more extensive than in any of the other alternatives due to the larger area available for both open pit and underground mining.

Impacts from sodium development would be similar to those cumulative effects described in the Wildlife Alternative.

Under this alternative, salinity at Imperial Dam could increase by approximately 2.89 mg/l. This salinity increase could represent a cost of approximately $1,560,000 for desalinization treatment at

Imperial Dam. Impacts caused by salinity would be greatest in this alternative.

Impacts from coal development would be similar to those described in the Current Management Alternative.

Impacts from oil and gas development would be less than those described in the Oil and Gas Alternative. However, the impacts would be only slightly greater than those impacts described in the Current Management Alternative.

Preferred Alternative

Under the Preferred Alternative, impacts to water quality and quantity from oil shale development would be similar to those described in the Oil and Gas Alternative. Water quality and quantity impacts from sodium, oil and gas and coal development would be similar to those described in the Current Management Alternative. Salinity impacts from all sources would be similar to those described in the Current Management Alternative.

Impacts caused by mineral development upon spring and stream reliant uses supplied by groundwater could be less in this alternative. This would be due to restrictions placed upon mineral development activities to protect water quality and quantity and a state approved augmentation plan if determined necessary to protect the water quantity.

VEGETATION

Vegetation Types

The primary negative impact of vegetation removal and modification of existing plant communities, due to surface disturbance associated with coal, oil and gas, oil shale and sodium development, would occur in all alternatives. The severity of this impact would be dependent on the quantity of acreage disturbed and mining technique utilized.

Current Management

Impacts resulting from implementation of the Current Management Alternative would be essentially the same as those described for terrestrial vegetation in the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980).

Continuation of current management in accordance with the White River Resource Area Management Framework Plan (USDI, BLM 1981) would increase the frequency of desirable herbaceous and browse species in the vegetation composition. Cover and production of desirable species would increase in all vegetation types.

Surface disturbance impacts and their effect on vegetation due to non-renewable resource development would be mitigated by prompt reclamation and revegetation with adapted species.

Wildlife Alternative

The impacts on vegetation as a result of selecting this alternative would be similar to those described for the Current Management Alternative with several exceptions. Fencing of specific areas as recommended in the proposed management for some of the Special Management Areas (12 are identified in this alternative) could have a negative impact on common native plant species by eliminating the beneficial impacts of livestock grazing.

The stricter regulation of surface disturbing activities on all lands in the planning area as proposed in this alternative would have a net positive impact on native plant communities in the area.

The present structure and composition of the plant communities in Piceance Basin is such that a 23 percent increase in deer AUMs is probably not attainable without a substantial man-induced manipulation and rejuvenation of the vegetation; particularly the mountain shrub, big sagebrush and upper elevation pinyon-juniper communities in deer transitional ranges. See related discussion under Livestock Grazing in this chapter.

Oil and Gas Alternative

The primary impact of this alternative would be the removal of vegetation and the resulting modification of the existing plant communities due to surface disturbance from oil and gas exploration and production. It would be reasonable to expect (given the right economic climate) that roughly 1,000-2,000 acres of vegetation would be destroyed on an annual basis if this alternative is selected. This activity would be relatively dispersed, but would occur primarily west of Piceance Creek.

The lack of adequate measures to prevent soil loss and rapid runoff from rights-of-way and oil and gas pads could result in accelerated erosion, thus permanently altering and degrading both downstream and downslope plant communities through desication and flood deposition.

Assuming 100 percent success in reclamation of areas not needed for production, native plant communities in which the development took place would nevertheless, be substantially altered both in structure and composition. For more specific information, consult the *White River Resource Area Oil and Gas Umbrella Environmental Assessment*.

Oil Shale Alternative

Full scale oil shale development, including surface mining, product transport and associated facilities could result in the disturbance of 25,000 or more acres of vegetation over the next 20 years. The majority of this disturbance would occur within the pinyon-juniper and big sagebrush vegetation types.

In the case of waste disposal areas, large scale long-term successful revegetation has yet to be demonstrated. It may be impossible to revegetate the post-disturbance area with native plant cover due to the problems associated with successful revegetation on a spent shale substrate.

Both the big sagebrush and pinyon-juniper plant communities within the Piceance Basin would be negatively impacted and probably, would be irretrievably altered.

Preferred Alternative

Environmental consequences to vegetation would be similar to those previously described in the Current Management Alternative.

Threatened, Endangered, Rare and Sensitive Plants and Remnant Vegetation Associations

All Alternatives

Impacts to rare and sensitive plants and remnant vegetation associations from the development of sodium, coal, saleable minerals, oil and gas, and oil shale could occur only if surface disturbances occur in areas of populations and feasible alternative project locations could not be utilized. The severity of future conflicts would depend on the project locations and the specific areas of surface disturbances which are presently unknown. The potential cumulative impacts to rare and sensitive plants and remnant vegetation associations would become significant if wide spread energy and mineral development occurs in the Oil and Gas and Oil Shale Alternatives. The most significant impacts resulting from surface disturbances would occur on exposures of the Green River Formation along the Cathedral Bluffs.

The effect of livestock grazing would have very similar impacts in all alternatives. However, the effect of grazing on rare and sensitive plants is currently unknown. Neither is it known if sensitive species are competitive with other plants in the community in the absence of grazing by domestic livestock. Historic and current livestock grazing levels have had insignificant adverse effects on species diversity and plant composition in the presently identified remnant vegetation associations. Presently, most remnant vegetation associations are in good condition. A change in grazing levels may adversely impact species diversity and plant composition. However, a change in grazing levels is not expected to adversely impact remnant vegetation associations because the development and implementation of Allotment Management Plans would provide for management objectives for maintenance of plant composition, diversity and physiological requirements of remnant vegetation associations and rare and sensitive plants. A part of the Allotment Management Plan process would be to locate range improvement projects in areas to achieve the management objectives of remnant vegetation associations.

Impacts from forest product sales on habitat of rare and sensitive plants is similar for all alternatives. Sawtimber sales which are proposed in Douglas fir remnant vegetation associations could adversely affect the site condition. Past forest management has had slight impacts on remnant vegetation associations while rare and sensitive plants are rarely affected by timber sales.

Current Management Alternative

Under this alternative, current policy is to avoid surface disturbances in areas of rare and sensitive plants and remnant vegetation associations. The protection of critical plant habitat is greater in this alternative than in the Oil and Gas and Oil Shale Alternatives, but less than in the Wildlife and Preferred Alternatives. Under current management, known populations of rare and sensitive plants may be lost to surface disturbing activities from mineral development if alternative project locations can not be located. Coordination with other resource activities to assure consideration of rare and sensitive plants and remnant vegetation associations would continue.

There are no existing Areas of Critical Environmental Concern, Research Natural Areas or Outstanding Natural Areas. Nor would any areas be af-

forded the management emphasis from such designation in this alternative.

Wildlife Alternative

The Wildlife Alternative provides the greatest potential of any alternative for protecting the habitat of rare and sensitive plant species and remnant vegetation associations. Implementation of this alternative would offer protection through avoidance stipulations by excluding surface disturbing activities, when possible, to all known populations of rare and sensitive plant species and remnant vegetation associations, except where prohibited by valid and existing rights. The intensive management offered under this alternative would allow for the spread, occupation of potential habitat, and stabilization of the rare and sensitive plants and remnant vegetation associations. This would reduce the impact and minimize the possibility of species becoming Federally listed as threatened or endangered by the U.S. Fish and Wildlife Service.

Most conflicts would be resolved in favor of rare and sensitive plants and remnant vegetation associations. Unavoidable conflicts would be mitigated to the extent possible by the responsible activity. A detailed monitoring program for sensitive plants would record the progress of management actions.

Oil shale and coal development would be limited to those methods causing the least amount of surface disturbance.

More stringent restrictions would be placed on oil and gas leases and drilling permits to minimize conflicts and secondary offsite impacts. Rare and sensitive plants and remnant vegetation associations would be avoided when possible in utility corridors to reduce the acreage of habitat impacted and to concentrate activities in less sensitive areas.

Intensive management of the soil and water resources as described in this alternative would benefit the rare and sensitive plants and remnant vegetation association conditions.

Designation and management of the 12 Special Management Areas would provide additional management emphasis and protection to rare and sensitive plants and remnant vegetation associations. Appendix B describes the management of these that would take place upon designation. The habitat of at least one population of each rare and sensitive plant species present within the planning area would be protected by designation in this alternative.

Oil and Gas Alternative

This alternative ranks moderately low in terms of potential management of rare and sensitive plants and remnant vegetation association habitat. The only alternative which provides less opportunity for site protection of critical habitat is the Oil Shale Alternative. The impacts would result from surface disturbances associated with the construction of linear facilities such as roads and pipelines from expanded oil and gas development. This would spread the impact over a greater number of vegetation communities. Development in areas of sensitive plant species could impact rare and sensitive plants and remnant vegetation associations. Even though surveys would be required in areas of known habitat, these populations could still be lost due to surface disturbance. If feasible alternative project locations could be found, this would reduce the impact to these sites and minimize their possible listing as threatened and endangered species.

Achievement of the BLM, Colorado Natural Areas Program (CNAP), and the U.S. Fish and Wildlife Service objectives to retain sensitive plants and remnant vegetation associations in their present or better condition would be difficult and require careful management consideration and monitoring.

Designation of three of the high priority Special Management Areas would provide additional management emphasis and protection to at least one population of the most sensitive rare and sensitive plant species present within the planning area. Appendix B describes management of these three areas under Special Management Area designation.

Oil Shale Alternative

The amount of surface disturbing activities would be the greatest under this alternative which would result in the largest potential for impacting rare and sensitive plant species and remnant vegetation associations. The oil shale management priority areas contain a large number of rare and sensitive plant populations and remnant vegetation associations. Large scale open pit mining could accelerate the rate at which these plants would be impacted. Significant cumulative impacts could result in the listing of certain species as threatened or endangered. The level of significance is unknown at this time and would depend on the project location and quantity of surface disturbance. Losses would be considered long-term and irretrievable because of the inability to reclaim remnant vegetation associations to their original condition and the lack of present data for the establishment of rare and sensitive plants during the reclamation process. Also, fluctuation of the groundwater quantity and quality,

as a result of mine dewatering, could significantly impact *Sullivantia purpusii* and *Aquilegia barnebyi* which are restricted to springs, seeps and perennial drainages on exposures of the Green River Formation.

Management would attempt to avoid critical habitat and maintain present conditions where feasible. Avoidance would be the most difficult with open pit mining operations.

The impacts from oil and gas activity and other mineral resources would be similar to those described in the Current Management Alternative.

No Special Management Areas would be designated in this alternative.

Preferred Alternative

The impacts to the rare and sensitive plants and remnant vegetation associations would be similar to the Current Management Alternative, but potential protection would be greater in this alternative. Rare and sensitive plants would receive more attention than in the Oil and Gas and Oil Shale Alternatives, and less than in the Wildlife Alternative.

More habitat protection would be provided to rare and sensitive plants and specified remnant vegetation associations through the incorporation of the avoidance stipulation to all potential surface disturbing activities and impacts. When present leases expire, the no surface occupancy stipulation would be applied to the known rare and sensitive plant populations and specified remnant vegetation associations. These locations would also be included in the *White River Resource Area, Oil and Gas Umbrella Environmental Assessment.* Management considerations for the remnant vegetation association and rare and sensitive plant locations in the Special Management Areas under the Preferred Alternative are specified in Appendix B.

The quantity of impacts from oil shale and oil and gas activities would be similar to those described in the Current Management Alternative. However, additional opportunities for management would be available for minimizing conflicts to rare and sensitive plants by considering the location of surface disturbance on a case-by-case basis.

The impacts resulting from forest product sales would be very similar to those described in the Current Management Alternative. Selected remnant vegetation associations and all rare and sensitive plan species locations would be given consideration in the preparation and implementation of Allotment Management Plans, discussed under All Alternatives.

The designation of the Soldier Creek ACEC would benefit two populations each of *Astragalus lutosus* and *Thalictrum heliophilum* and one population of *Aquilegia barnebyi*.

Seasonal and permanent ORV road closures would reduce the disturbance in areas of known habitat. Placement of major linear utilities in designated corridors would benefit rare and sensitive plants and remnant vegetation associations. Avoidance criteria would further protect sensitive plant species from major linear rights-of-way outside designated corridors.

Livestock Grazing

Livestock forage would be lost in each alternative from surface disturbing activities necessary for coal, oil shale, oil and gas, and sodium development. The severity of this impact would be dependent on the quantity and location of acreage disturbed, and the mining techniques utilized.

Current Management Alternative

Impacts resulting from the continuation of the Current Management Alternative would be essentially the same as those described for livestock grazing in the *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980).

Continued implementation of the Grazing Management Program would result in an increase in forage production on Piceance Basin grazing allotments. This would positively affect the quantity and quality of livestock forage production and thus increase economic returns to the livestock operations involved.

Wildlife Alternative

The impacts of this alternative on livestock grazing would be beneficial primarily because the alternative would severely restrict surface disturbance created by oil shale and oil and gas development.

The major negative impact of this alternative on livestock grazing would be the loss of approximately 600 AUMs due to the exclusion of livestock from portions of the Special Management Areas. The proposed management in two of the proposed areas, Deer Gulch and Dudley Bluffs would severely impact two livestock operations.

One alternative to the man-induced manipulations of the vegetation mentioned previously (in Environmental Consequences, Vegetation Types, Wildlife Alternative) would be a drastic upward adjustment in stocking rates and timing of livestock grazing. This adjustment would have to far exceed (75 percent minimum) the proposed livestock allocation for this alternative if it were to produce the desired effect of substantially changing the structure and composition of the plant communities for the long-term benefit of mule deer. Simply, this would be a shift from increasingly grass-dominated communities to browse-dominated plant communities. Such a manipulation is probably not feasible from an environmental standpoint and in light of the present marginal economic status of the range livestock industry.

Oil and Gas Alternative

Assuming a moderate rate of growth in oil and gas exploration and development roughly 1,000-1,200 forage producing acres would be disturbed on an annual basis. Within three-five years, approximately 25-50 percent of this acreage could be expected to be suitably revegetated. Some of this acreage, particularly that which occurs in the pinyon-juniper type would be more productive in its post revegetated state. The remaining 50 percent of the acreage would be permanently lost to forage production due to facilities, roads and active well pads. This represents a significant level of on and off site loss of forage over the next 20 years. For further information on cumulative impacts to livestock grazing, consult the *White River Resource Area Oil and Gas Umbrella Environmental Assessment* (USDI, BLM February 1982).

Livestock forage loss from oil shale development would occur to a greater extent than in the Current Management Alternative.

Oil Shale Alternative

The negative impacts associated with this alternative would be very similar to those described for the Oil and Gas Alternative, although the direct forage loss would be of greater magnitude. This forage loss would be concentrated on six allotments (Piceance Mountain, Fawn Creek, Black Sulphur, Square S, Reagles and Yellow Creek) rather than dispersed throughout the western part of the Piceance Basin as described for the Oil and Gas Alternative.

At moderate to high levels of development in this scenario, the loss of forage on critical spring ranges would probably eliminate four livestock operations as economic units.

The likelihood of successful revegetation for livestock forage would be reduced by the problem of heavy metal accumulation in plants growing on spent shale substrates.

Preferred Alternative

Environmental consequences to livestock grazing would be similar to those previously described in the Current Management Alternative.

Forestry

All Alternatives

Each alternative (except the Wildlife Alternative) identifies the potential leasing of tracts for coal surface mining and open pit oil shale development. These areas identified for leasing all contain stands of commercial forest land, primarily pinyon/juniper woodlands. If developed, stands located within lease boundaries would eventually be lost to production over the long-term, potentially reducing the commercial forest land base and allowable cut figure for the White River Resource Area.

Current Management Alternative

Under current management, all forest management objectives including volumes sold, meeting public demand, perpetuation of forest land and preparation of a forest management plan would be accomplished for both sawtimber and firewood. Some acres would continue to be lost to forest production due to energy related activities.

Wildlife Alternative

Implementing the Wildlife Alternative could seriously affect sawtimber management in the planning area where Special Management Area designation precludes timber harvest. Three Special Management Areas (Deer Gulch, North Cathedral Bluffs and Soldier Creek) include the highest quantity and quality of Douglas fir commercial forest land in the White River Resource Area. If these areas are lost to timber harvest, approximately 75 percent of all commercial forest land acres in the White River Resource Area would be withdrawn from production. This would nearly eliminate the harvest of Douglas fir sawtimber, as other areas having commercial forest land presently have severe access problems. This would result in the public demand for sawtimber not being met, nor would current BLM

commitments, through the 5-year sale plan, be accomplished.

Impacts to pinyon/juniper woodland management (firewood) would be the same as those described in the Current Management Alternative.

Oil and Gas Alternative

Volumes of sawtimber available under this alternative would probably exceed the public demand for forest products. Sales would be prepared and offered for sale, but may not be sold. This could result in conflict with forest management objectives. Designation of the Deer Gulch Special Management Area would exclude harvest of sawtimber products.

The increase in volume sold from pinyon/juniper woodlands (firewood) would probably be due to an increase in land clearing for oil and gas activity. There would be no control over the eventual use of this timber. The public demand for these forest products would not necessarily be met. Fewer acres would be available for intensive forest management activities.

It is anticipated that a significant increase in number of acres lost to forest production would occur, in comparison to the Current Management Alternative. This would result in a decrease in total commercial forest land base. It is also anticipated that there would be insufficient time to conduct compliance on energy related harvesting of timber.

Oil Shale Alternative

Under this alternative, sawtimber volumes would not meet the public demand for forest products. Local businesses may find Douglas fir very difficult to find in adequate quantities. Lack of a forest management plan conflicts with current forest management objectives.

Planned harvest levels for pinyon/juniper woodlands (firewood) would be less than half the present anticipated public demand and sustained yield volumes. BLM commitments, through the 5-year sale plan, would not be accomplished. Range and wildlife improvements possible from pinyon/juniper firewood sales would be foregone.

The area identified for open pit oil shale leasing contains a significant portion of all commercial forest land acres of pinyon/juniper woodland, including a concentration of especially high quality stands in the Wagonroad Ridge vicinity. At present, there exist nine commercial timber sales with two or three year contracts on Wagonroad Ridge. Several more are planned over the next few years.

All stands located in development areas could eventually be lost to production over the long-term, significantly reducing the number of commercial forest land acres in the planning area.

Preferred Alternative

Impacts from this alternative would be similar to those described in the Current Management Alternative. The boundary redelineation for the Soldier Creek Special Management Area has eliminated any potential conflicts with the harvest of sawtimber products.

WILDLIFE

The alternatives ranked overall with the greatest to least potential for adversely impacting the wildlife resource are: Oil Shale, Oil and Gas, Current Management/Preferred, and Wildlife. The Oil Shale Alternative ranks greatest due to the large acreages of surface disturbance and secondary impacts that could be expected. In comparison, the Oil and Gas Alternative would have fewer impacted acreages, but due to the scattered development patterns, impacts would be dispersed and affect a widespread area. Impacts of the Current Management and Preferred Alternatives would be similar, resulting from a moderate quantity of surface disturbance with management emphasis for mitigation. The Wildlife Alternative would provide the least impacts because of a significant reduction in surface disturbance and application of more stringent mitigation requirements.

All Alternatives

Development of five existing sodium leases and three Preference Right Lease Applications, if leased, would adversely impact mule deer severe winter range. These lease tracts include 15,460 acres or 13 percent of the severe winter range on public land in the planning area. Development would not occur tract-wide for each lease, but where disturbance does occur, it would reduce forage availability and habitat effectiveness for mule deer.

Mining of coal in the identified management priority areas would result in the loss of winter forage and increased human disturbance. Depending on project location, these impacts would occur on winter range, winter concentration areas, or severe

winter range for mule deer and on elk winter range. The severity of this impact would depend on the location of lease tracts, mining technique utilized, and acreage of surface disturbance.

Development and implementation of grazing systems and rangeland improvement projects would benefit wildlife by increasing forage availability and reducing livestock-wildlife dietary competition. Minimum forage rest requirements, water developments, and fencelines would improve livestock distribution patterns, thereby reducing livestock use of browse. Some livestock-wildlife conflicts would continue to occur, but would be minimized by incorporating multiple-use guidelines and recommendations during Allotment Management Plan preparation and implementation. Management of wild horses would similarly benefit wildlife by maintaining an acceptable herd population to minimize wildlife-wild horse competition for forage and water.

Wildlife habitat would be improved through implementation of a Fire Management Plan allowing wildfire to burn in areas where desired resource benefits would result. Natural fire would provide similar positive benefits, as would wildlife habitat improvement projects designed to rejuvenate vegetation of low preferred forage production and poor nutritional values.

Exclusion of developmental impacts from Mandatory Protection Areas would adequately protect nesting raptors, and bald eagles in all alternatives.

Additional human encroachment above present levels could displace disturbance-intolerant species such as mountain lion, black bear, and raptors. Activities permitted in any alternative that would reduce water flow or degrade water quality in the White River could adversely affect the endangered fish species present.

Carrying Capacity

A threshold habitat carrying capacity of 24,900 animals (24,650 AUMs) has been established for wintering mule deer on public land in the Piceance Basin. (Note: The BLM and Colorado Division of Wildlife estimated a minimum acceptable population of 30,000 wintering mule deer in the Piceance Basin. The 24,900 deer population figure is the 83 percent which actually winter on public land habitat.) This threshold is the minimum level which, if exceeded, could result in significant irretrievable effects on the deer herd and management objectives for this resource.

The current mule deer winter range carrying capacity level based on present management objectives and forage allocation levels is 26,835 mule deer (27,106 AUMs). Cumulative impacts from existing energy activities and future projects which adversely impact the habitat carrying capacity for mule deer must be continuously monitored and compared to current and minimum habitat carrying capacities. Acreage, location and duration of impact, and mitigation implemented to ameliorate impacts must be evaluated. Hopefully, the impact prediction model recently developed by the Northwest Colorado Wildlife Consortium could be used for this evaluation process. Violation of the wildlife threshold would occur if the present carrying capacity level is reduced by 1,935 animals (2,456 AUMs). Translated into area of disturbance, this could range from 20.5 to 61.4 square miles depending on the specific habitat carrying capacity levels and population densities of the site impacted. Within the basin these levels vary from 40 mule deer/square mile on winter range to 120 mule deer/square mile on winter concentration areas. If this threshold of 24,900 animals (24,650 AUMs) is reached, development would be constrained either by prohibiting further leasing or leasing with such stringent mitigation requirements that no site specific or cumulative adverse impacts to mule deer would occur. This would allow flexibility in mineral leasing. Leasing could consist of either several actions with minimal wildlife mitigation or many actions with stringent wildlife mitigation. It should be noted that this threshold level limitation is in addition to and separate from the normally required wildlife mitigation actions on surface disturbing activities. BLM would not reduce livestock grazing use to decrease livestock/wildlife forage competition or to supplement forage available to wildlife for the purpose of avoiding the violation of this wildlife threshold.

Large scale projects would have the greatest impact on the threshold situation. Accelerated energy development in either the Oil Shale or Oil and Gas Alternative would have the greatest potential for conflicting with this threshold. Once leasing occurs in any alternative, reassessment of the threshold situation must occur.

Current Management

Condition and production of mule deer and elk winter ranges would be improved from habitat improvement projects. Data from habitat monitoring would assist in management direction and decision making actions.

Coordination with other resource activities to assure consideration of wildlife habitat values would continue. The programs most likely to influence the wildlife resource are minerals, range, and forestry.

Mineral development has the greatest potential for significantly impacting the wildlife resource through habitat destruction and increased human disturbance. The severity of this impact would be directly related to the location, quantity, and type of development. To date, oil and gas operations have adversely modified the largest acreage of habitat in the Piceance Basin. Ranking second would be oil shale activities. However, wildlife habitat would be affected to a greater extent from commercial oil shale operations, once development begins in earnest.

Oil and gas activities have impacted wildlife habitat principally through displacement of animals and habitat destruction. The quantity of habitat disturbed has been low. However, due to the linear configuration of the facilities (e.g., roads and pipelines), impacts have been dispersed over a widespread area. Human encroachment associated with exploration, development, and production has caused wildlife to avoid areas of disturbance. Impacts have occurred throughout the planning area with the greatest intensity in Known Geologic Structures and producing oil and gas fields.

Oil shale development could occur on up to eight designated tracts that are grouped together to concentrate impacts. Underground mining would probably be utilized. Impacts would occur in similar quantities on mule deer winter range, mule deer severe winter range, and mule deer/elk summer range. Surface disturbance would reduce habitat available for forage and cover until the site is successfully reclaimed. Habitat could be unsuitable for wildlife use for the entire project life which could last up to 150 years. Of equal importance would be the animal displacement from mine activity and secondary impacts of community expansion, additional recreation use and poaching.

Past forest product sales have benefitted wildlife habitat quality. Sawtimber sales have increased herbaceous forage production on mule deer/elk summer ranges. Firewood sales have opened closed canopy pinyon-juniper stands resulting in increased edge effect and understory production. In general, sales convert decadent stands used by big game for escape and thermal cover to productive, sparse stands useful for foraging.

Wildlife Alternative

Intensive wildlife management actions would improve overall wildlife habitat conditions, increase winter forage production for mule deer and elk, and reduce human disturbance to sensitive species and to species during crucial time periods. Improved winter range conditions would allow for a mule deer and elk population increase of 23 percent and 8 percent, respectively.

In this alternative, conflicts with other resource activities would be resolved in favor of wildlife. Unavoidable conflicts would require mitigation by the activity responsible.

Oil shale and coal development activities would be limited to methods causing the least amount of surface disturbance. Adverse impacts would be minimized by locating development in low priority wildlife areas. Secondary impacts would be minimized by sequential leasing promoting phased population growth. Conflicts from oil and gas would be minimized through application of more stringent restrictions on leases and drilling permits. Mass transportation of products would reduce vehicle/wildlife collisions. Designation of utility corridors would reduce the acreage of habitat potentially impacted and concentrate impacts in specific areas.

Intensive management of soil and water resources would benefit wildlife habitat conditions. Forest product sales would be designed to improve habitat conditions.

Oil and Gas Alternative

The management emphasis for this alternative would adversely impact the quality of big game winter ranges. A decline in habitat effectiveness from animal displacement would be the most significant consequence followed by direct loss of habitat from surface disturbance. Activities during the winter season would increase stress upon big game and possibly increase winter mortality. Expanded oil and gas development would distribute these impacts over the majority of the planning area. Achievement of BLM and Colorado Division of Wildlife big game population objectives and adherence to the carrying capacity threshold may be difficult in a high oil and gas development situation under this alternative.

Moderate levels of oil shale development in priority areas would occur on and impact mule deer winter range and to some extent mule deer/elk summer range. Emphasis on timber product sales would increase the rate of stand conversion as described in the Current Management Alternative.

Oil Shale Alternative

Impacts to wildlife would be the most significant of any alternative. The level of significance depends on the size, location, and type of oil shale

development projects. Large acreages of wildlife habitat would be impacted over the long-term from oil shale surface disturbances. Several different mule deer subherd populations would be impacted due to the alternative emphasis of dispersing tract locations over a widespread area. Development of oil shale priority areas could affect a large portion of the critical mule deer and elk habitats in the planning area. The greatest quantity of secondary impacts associated with population growth would also occur.

Wildlife management efforts would be directed to maintaining short-term big game BLM and Colorado Division of Wildlife population objectives by maintaining or improving populations in non-development areas and mitigating wildlife impacts in oil shale development areas. The long-term BLM and Colorado Division of Wildlife big game population objectives may only be 80-85 percent achieved.

Impacts from oil and gas activities would be similar to those described for the Current Management Alternative.

Preferred Alternative

Wildlife habitat would be managed as previously described for the Current Management Alternative. Adjustments in management strategies and population carrying capacities may be necessary in oil shale management priority areas if development occurs. An industrial association would be established involving government agencies and energy development companies to coordinate and mitigate wildlife impacts on a regional basis.

Oil shale management priority areas were established for potential development in locations of minimal conflict with other resources. The open pit priority area does not contain mule deer severe winter range. The underground priority area is located adjacent to the open pit area and along the southern portion of the planning area (see Oil Shale Alternative map in the Map Addendum). This would benefit wildlife by: (1) locating open pit and underground development areas together and (2) locating underground development on winter range used by the Roan Plateau mule deer subherd. It is speculated that accelerated oil shale underground mining on public land would occur after oil shale development on private lands (Union, Colony, and Chevron) commences. This development would have already impacted the Roan Plateau subherd by reducing the summer range carrying capacity. Therefore, development in the designated underground area would concentrate impacts to one deer subherd already impacted and not to other unimpacted subherds wintering in the planning area. Extensive impacts to mule deer from oil shale development would also be limited by the threshold/minimum carrying capacity level.

Impacts from oil and gas exploration, development, and production would be similar to those described for the Current Management Alternative. However, additional emphasis to minimize surface disturbance, require prompt and successful reclamation, and perform additional project compliance would reduce impact intensity to wildlife during and following project activities.

Consequences to the wildlife resource from forest product sales would be similar to the Current Management Alternative. Designation of the Soldier Creek Area of Critical Environmental Concern would benefit the state threatened Colorado River cutthroat trout in habitats immediately adjacent to the planning area. Seasonal and permanent off-road vehicle closures would reduce disturbance to wildlife during crucial seasons. Placement of major linear facilities in designated corridors would benefit wildlife. Avoidance criteria would protect sensitive wildlife values for major linear utilities routed outside designated corridors.

WILD HORSES

Wild horse habitat and forage would be lost in each alternative from surface disturbing activities necessary for oil and gas, and oil shale development. The severity of this impact would be dependent on the quantity and specific location of acreage disturbed and the mining technique utilized.

Current Management Alternative

Impacts resulting from continuation of the Current Management Alternative would be essentially the same as those described for wild horses in "Environmental Consequences, Alternative A", *Proposed Grazing Management Program for the White River Resource Area, Draft Environmental Impact Statement* (USDI, BLM April 1980).

Adoption of the Current Management Alternative would assure continued implementation of the 1982 Piceance Herd Management Area Plan for wild horses. The net result would be an improvement in forage quality and availability for wild horses. Long-term vegetation allocations would provide for maximum and minimum herd sizes of 140 and 65 wild horses respectively. Those bands would be man-

aged to minimize inbreeding within bands and to maintain the herd's effective populations.

Wildlife Alternative

The impacts of this alternative on wild horses would be essentially the same as those described for the Current Management Alternative; the key exception would be fencing of selected areas within the Special Management Areas designated within the wild horse range. This fencing would have a negative impact on the free ranging character of the horses and is not compatible with the current policy on management and maintenance of wild horses within their range.

Oil and Gas Alternative

As noted in the *White River Resource Area Oil and Gas Umbrella Environmental Assessment* (USDI, BLM February 1982), in addition to the direct forage loss discussed in both previous sections, all impacts on wild horses would be negative. These would include reduction in the amount of wild horse habitat, increased human disturbance, and modification of the horses' patterns of movement and concentration. As much as 75 percent of the accelerated oil and gas activity identified in this alternative would be expected to occur within the Piceance Herd Management Area.

Impacts to wild horse range from oil shale development would be greater than in the Current Management Alternative, but less than in the Oil Shale Alternative.

Oil Shale Alternative

Impacts on wild horses associated with full scale oil shale development would be similar to those described for oil and gas; however, these impacts would be more concentrated, and in the case of development in the C-a area, would probably eliminate horses from their designated range in Pasture C (Square S Allotment) and the Boxelder Pasture and 84 Mesa area within the Yellow Creek Allotment.

Any development of oil shale in this area would have to provide for maintenance of the herd on their designated range.

Preferred Alternative

Environmental consequences to wild horses would be similar to those previously described in the Current Management Alternative.

CULTURAL RESOURCES

Current Management, Oil and Gas, and Preferred Alternatives

Under these alternatives, cultural resources are not anticipated to be significantly impacted. The standard compliance mechanisms which are normally used would insure the adequate consideration of cultural resource values prior to any Federally permitted surface disturbing activity. The management of cultural resources is a support program and operates primarily in response to other surface disturbing Bureau programs and authorized activities.

No acreage figures are available at this level of planning therefore, an estimation of sites which could potentially be disturbed cannot be calculated at this time. When site-specific analyses are done, the Piceance Basin class II predictive model (Newkirk and Roper 1983) and existing class III inventory data will be used to assess impacts.

The Duck Creek Wickiup Village (5RB53) is currently listed on the National Register of Historic Places and has been protected through fencing. Any proposed surface disturbing activity to cultural resources listed on or determined to be eligible to the National Register would be assessed through the Section 106 process and mitigated in consultation with the State Historic Preservation Officer and the Advisory Council on Historic Preservation.

Vandalism of cultural resources would be an indirect adverse impact. Increased access to public land users, construction crews and energy workers would increase the amount of unrestrained damage which would be done to archaeological and historic sites. The lack of personnel and funds makes Federal surveillance an unreliable method of preventing site destruction or theft of artifacts in the planning area.

Wildlife Alternative

A slight reduction in adverse impacts to cultural resources as described above would occur under this alternative due to the lesser amount of anticipated surface disturbance. Some beneficial impact could result from the reduction in development.

Oil Shale Alternative

This alternative would result in the greatest amount of surface disturbance. Therefore, impacts to cultural resources would increase. The impacts would be of the same type as those discussed above.

PALEONTOLOGICAL RESOURCES

Current Management Alternative

Paleontological resources would be unavoidably disturbed and irretrievably destroyed by all surface disturbing activities. Oil shale open pit and coal surface mining would have the largest impact followed by other types of mineral development. The impact cannot be adequately addressed as paleontological resources have not been extensively inventoried in the planning area. Significant fossils have been found throughout the planning area although not in abundance.

Impacts would vary in magnitude ranging from the lowest potential under the Wildlife Alternative to the highest potential under the Oil Shale Alternative. However, all activities that affect paleontological resources are regulated by the following laws and regulations. The Federal Land Policy and Management Act of 1976, Section 202(c) and 302(b) directs the Bureau to protect vertebrate, invertebrate and plant fossils of scientific interest. Section 30 of the Mineral Leasing Act of 1920 as amended authorizes lease terms to protect the public interest and resources which would include paleontological resources. Prior to the approval of a coal mining permit, under Section 30 CFR Part 710.11 an inventory of the surface will be conducted for paleontological resources. Under an agreement with the U.S. Geological Survey and Office of Surface Mining, BLM maintains custody of all paleontological resources on BLM managed surface lands. Paleontological resources are protected from locatable mineral development by the regulations of 40 CFR Part 3809 and the Antiquities Act of 1906, which protects any object of antiquity which is of scientific interest. These regulations, laws and acts would apply to all alternatives.

Wildlife Alternative

Impacts would be similar to those identified in the Current Management Alternative although the potential would decrease along with decreased surface disturbance.

Oil and Gas Alternative

Impacts would be similar to those described in the Current Management Alternative. The magnitude could be greater depending on development of oil and gas and oil shale resources.

Oil Shale Alternative

Potential impacts would be similar to those described in the Current Management Alternative. The magnitude of impacts however, could be greater than the Oil and Gas, Current Management or Preferred Alternatives.

Preferred Alternative

Impacts would be similar to those described in the Oil and Gas Alternative.

RECREATION

All Alternatives

Lack of management attention to any segment of the recreation resource, but especially campsites and hunting concentration areas, would cause increased soil, vegetation, wildlife, visual, fire and maintenance impacts.

Impacts to recreation from oil shale development include restricting access to lands utilized for mining, operations and disposal. The amount of land inaccessible would depend upon actual recovery rates and schedules, future leases, submission of plans of development, etc. It is estimated that a-

creage could range from 11,000 to 59,000 acres, however it is unlikely that all lands would be closed to public access simultaneously. Closure could last upwards of 200 years, but would probably be limited to 100-125 years.

Oil and gas activity, specifically road building and linear rights-of-way, would increase vehicular access in the basin. This increase, while possibly beneficial, would cause increased wildlife harassment, fire hazard and maintenance problems. Increases would correlate to the level of activity and influx of workers in each alternative.

Special Management Areas, wildlife, non-motorized hunting and/or other proposed off-road vehicle (ORV) restrictions would restrict motorized access and therefore displace some users, but also enhance the spectrum of recreational opportunity by creating non-motorized areas. Wildlife harassment would be lessened and recreators would find the opportunity for increased solitude. Refer to Appendix C for more detail on areas proposed for permanent and temporary ORV closures or restrictions.

The recreation opportunity spectrum Table IV-2 shows acreage and percentage for the BLM lands and ALL ownership in separate categories for each alternative . A comparison is shown for the existing situation as a reference for degree of change. Discussion within the text is based on change in BLM ownership. ALL ownership is shown for reference only, but is important to point out that in some classes (such as rural), most of the area is controlled by private or state ownership, and activities on public lands may not effect this classification to any great extent. It should be noted that these figures are estimates based on conversion of planned activities to on-the-ground changes. Of course, just because an activity is planned does not mean that activity would in fact occur. Also note that seasonal closures are classified in the semi-primitive non-motorized class, but realistically, would revert back to the classification they originated from when the closure was not in effect. This means that during the time that these areas were open to motorized vehicles, the tables would be misleading. Except for permanent closures, the figures in semi-primitive non-motorized would be taken out of semi-primitive motorized and added to the semi-primitive non-motorized and roaded natural classes (at the ratio of about 7 acres into semi-primitive non-motorized for each acre into roaded natural). Consult Appendix C for details on permanent and seasonal closures.

TABLE IV-2

RECREATION OPPORTUNITY CLASSES PERCENT/ACRES

Alternative/Ownership	P	SPNM*	SPM	RN	R	MU
Existing Sit-BLM	0/0	0.0/0	82.6/499,453	13.8/83,387	3.5/21,070	0.1/518
Existing Sit-All	0/0	0.0/0	80.6/650,183	12.4/99,780	6.9/55,562	0.1/765
Current Mgmt-BLM	0/0	0.0/0	81.8/494,008	13.0/78,673	3.4/20,870	1.8/10,877
Current Mgmt-All	0/0	0.0/0	80.0/644,738	11.2/90,480	6.8/55,062	2.0/16,210
Wildlife Alt-BLM	0/0	2.4/14,600	79.4/480,408	12.9/77,874	3.5/20,870	1.8/10,676
Wildlife Alt-All	0/0	1.8/14,600	78.3/631,138	11.1/89,280	6.8/55,062	2.0/16,210
Oil & Gas Alt-BLM	0/0	0.8/5,000	75.1/453,908	16.9/101,873	3.6/21,870	3.6/21,777
Oil & Gas Alt-All	0/0	0.6/5,000	78.5/632,638	9.9/80,080	7.0/56,063	4.0/32,510
Oil Shale Alt-BLM	0/0	0.8/5,000	74.4/449,508	11.5/69,873	3.5/20,870	9.8/59,177
Oil Shale Alt-All	0/0	0.6/5,000	72.5/584,738	8.7/70,280	7.5/60,562	10.7/85,710
Preferred Alt-BLM	0/0	0.8/5,000	76.4/461,908	14.7/88,874	3.5/20,870	4.6/27,777
Preferred Alt-All	0/0	0.6/5,000	72.4/584,738	12.8/103,280	7.6/61,063	6.6/53,210

P = Primitive
SPNM = Semi-primitive non-motorized
RN = Roaded natural
R = Rural
SPM = Semi-primitive motorized
MU = Modern urban
* includes seasonal designation.

Summary of Recreation Opportunity Spectrum (ROS) Class Change by Alternative

The following is a summary of the changes in ROS classes for each alternative as illustrated in Table IV-2.

Primitive - None of the alternatives would provide any recreation opportunity in a primitive setting.

Semi-Primitive Non-Motorized - The semi-primitive non-motorized class ranges from a low of zero percent of the basin in the Current Management Alternative to 2.4 percent (14,600 acres) in the Wild-

life Alternative. In all alternatives, provision for a non-motorized setting is low-perhaps below demand even in the highest alternative. Approximately 25 hunters per day, based upon a quality experience not exceeding three hunters per square mile, would be provided a non-motorized setting within all alternatives except current management and wildlife. No opportunity is available in current management, and a capacity of about 75 hunters per day would be provided for in the Wildlife Alternative.

Semi-Primitive Motorized and Roaded Natural - Due to the high percentages of acreage in these categories, there is a relatively small percentage change between alternatives. No perceivable change would occur, except within the Cathedral Bluffs unit of the Special Recreation Management Area which would get the bulk of Tract C-a oil shale development. There, a loss of semi-primitive motorized and roaded natural and a gain in modern urban and rural would be obvious. For the most part though, use would simply shift to other areas capable of providing a similar experience.

Rural - Change in this setting would be consistently low in all alternatives. Some shifting from one location to another might occur (i.e. one parcel of rural changes to modern urban, but another parcel of roaded natural changes to rural), but the total acreage classified rural stays about the same. No perceivable change in available rural opportunity would occur other than a possible locational change.

Modern Urban -- The most significant change in setting would be where modern urban increases - as it does in all alternatives. The greatest changes occur in the Oil Shale Alternative (9.8 percent of the basin compared to 0.1 percent now) and Preferred Alternative (4.6 percent versus 0.1 percent now). The real effect of this change would be to displace many recreators, especially hunters, as the oil shale developed lands would be closed to indiscriminate public entry. Much of the land which changes to modern urban would have previously have been semi-primitive motorized or roaded natural. A change to a setting with high use, smoke plumes, stacks, asphalt roads, large industrial buildings, disposal piles, etc. would be dramatic and very noticeable.

Current Management

Recreation Opportunity Spectrum (ROS) classes would remain narrow, with the most lands in the semi-primitive motorized and roaded natural classifications (see Table IV-2). Recreation Opportunity Spectrum classes in the Current Management Alternative have the least change of any alternative. No non-motorized classes exist to fulfill user needs, but instead the trend is towards a more rural and modern urbanized setting caused by oil and gas and oil shale development. Full potential for recreation goes untapped in this alternative, with user demand for water based recreation and improved hunting and camping conditions unaddressed. The Colorado State Comprehensive Outdoor Recreation Plan priority management recommendations for BLM are met.

Wildlife Alternative

The Wildlife Alternative is most compatible with the objectives of a sound recreation management program. Surface disturbing activities are minimized, while all Colorado State Comprehensive Outdoor Recreation Plan priority recommendations for high need activities are provided for at the highest level (this includes ORV, picnicking, camping and nature study). Additionally, river access would be opened up to meet expected demand. More ORV restrictions and closures occur in this alternative than any other, but this could have positive impact to counteract the negative aspects. While some hunters and ORV enthusiasts may be displaced to adjacent areas, those recreators who desire a non-motorized area would find 14,600 acres in which they can have a semi-primitive non-motorized opportunity. Approximately 9,600 acres of this permanent closure would result from Special Management Area proposals, while the remaining 5,000 acres are from temporary closure in the proposed non-motorized hunting area. On a peak hunting day, as many as 150 people could be forced to abandon their vehicles, and take to hunting on foot or horseback. If they do not desire to do so, they would be displaced to other areas. As many, or perhaps more people could be attracted to these areas for the semi-primitive non-motorized experience.

An additional 14,400 acres of Special Management Areas would have a permanent ORV restriction which would require motorized vehicles to stay on existing designated roads and trails. Some 162,500 acres of seasonally restricted areas would be the result of closing mule deer severe winter range from approximately December to April, allowing access only to those with prior and existing rights or special permit. (Since some motorized vehicles will be allowed access, this figure is not reflected in Table IV-2.) All BLM roads and trails could be closed when weather conditions cause roads to be saturated to three inches. Sensitive watersheds, not yet identified, could have ORV restric-

tions at a future date. See Appendix C for more details. The table shows that the most significant Recreation Opportunity Spectrum changes will occur in the modern urban class and semi-primitive non-motorized classes, with increases in both. The overall change in Recreation Opportunity Spectrum classes is the second lowest, but most desirable of all the alternatives (only Current Management is less, but it does not promote an active recreation program).

Oil and Gas

Impacts are similar to the Current Management Alternative, except 5,000 acres would be closed to motorized vehicles seasonally in the non-motorized hunting area. An additional 5,500 acres would have permanent off-road regulations requiring vehicles to stay on existing roads and trails. All BLM roads and trails could be closed when they be come saturated to three inches during the wet season. See Appendix C for more information. Some 16,100 acres would be inaccessible due to oil shale development. These developments would shift the subject lands into the modern urban class.

Since emphasis would be on oil and gas development, many new roads and well pads would be constructed. This would likely cause semi-primitive motorized areas to drift toward a roaded natural classification. About 5,000 acres in the non-motorized hunting area would change from semi-primitive motorized to semi-primitive non-motorized.

Hunters and ORV enthusiasts would find some 5,000 acres closed seasonally. Similar impacts have been discussed in the Wildlife Alternative. Demand for water based recreation is not met.

As shown in Table IV-2, the most significant shifts would be from semi-primitive motorized to roaded natural and modern urban. Of the BLM lands in the basin, there would be an 8 percent decrease in semi-primitive motorized shifts to roaded natural (up about three percent) and modern urban (up 3 1/2 percent). The semi-primitive non-motorized class increases from a base level of zero up to 5,000 acres, or to 0.8 percent of the BLM ownership. The most apparent change in the basin, considering all public and private lands, would be in the increase of modern urban settings.

Oil Shale Alternative

The Oil Shale Alternative is least compatible with recreation. Mining and processing operations would cause an influx of workers into the region who would increase already heavy hunting levels and cause additional stress to big game herds. The spectrum of recreational opportunity would shift away from the existing semi-primitive motorized class and toward the rural or modern urban class. As shown in Table IV-2, the most significant changes would occur in decreasing semi-primitive motorized opportunity on BLM from 82.6 percent to 74.4 percent of the basin and increasing modern urban on BLM from 0.1 percent to 9.8 percent.

From a recreation program funding standpoint, this would be the most costly alternative to implement, due to the need for additional manpower and the cost of project development.

The inherent character of the basin, which has annually drawn thousands of recreators into the area, would be changed by widespread development and related activities (such as ORV use, traffic, corridors, smoke plumes, etc.). Access to public lands would be restricted on approximately 26,000 acres by operations, mining and disposal activity. Hunting and other recreation use would shift to other areas in the Piceance Basin until the quality of experience (in terms of solitude, crowding, big game herds numbers, safety and success rate) declined to the point where users would select other regions for their desired activities. Impacts and enhancement caused by seasonal road closures in the non-motorized hunting area (5,000 acres) are similar to those in the Wildlife Alternative.

Increased recreational use would require a substantial BLM workload for patrol, information, protection, enhancement and management. The proposed developed ORV area would cause some environmental degradation, including soil erosion, vegetation destruction, noise, dust, fire hazard, wildlife disturbance and livestock displacement. It is possible that the area would be located in an already disturbed site and may actually confine these sorts of impacts to one location which could be more easily controlled and maintained.

Preferred Alternative

The Preferred Alternative would result in an overall improved recreation management situation. This effect is due in part to the diversification of the recreation opportunity spectrum classes and an improved big game herd. Also, creation of a special recreation management area (SRMA) and preparation of a Recreation Area Management Plan would clarify program goals and objectives, and direct energies to much needed programs and site specific projects.

life Alternative. In all alternatives, provision for a non-motorized setting is low-perhaps below demand even in the highest alternative. Approximately 25 hunters per day, based upon a quality experience not exceeding three hunters per square mile, would be provided a non-motorized setting within all alternatives except current management and wildlife. No opportunity is available in current management, and a capacity of about 75 hunters per day would be provided for in the Wildlife Alternative.

Semi-Primitive Motorized and Roaded Natural - Due to the high percentages of acreage in these categories, there is a relatively small percentage change between alternatives. No perceivable change would occur, except within the Cathedral Bluffs unit of the Special Recreation Management Area which would get the bulk of Tract C-a oil shale development. There, a loss of semi-primitive motorized and roaded natural and a gain in modern urban and rural would be obvious. For the most part though, use would simply shift to other areas capable of providing a similar experience.

Rural - Change in this setting would be consistently low in all alternatives. Some shifting from one location to another might occur (i.e. one parcel of rural changes to modern urban, but another parcel of roaded natural changes to rural), but the total acreage classified rural stays about the same. No perceivable change in available rural opportunity would occur other than a possible locational change.

Modern Urban -- The most significant change in setting would be where modern urban increases - as it does in all alternatives. The greatest changes occur in the Oil Shale Alternative (9.8 percent of the basin compared to 0.1 percent now) and Preferred Alternative (4.6 percent versus 0.1 percent now). The real effect of this change would be to displace many recreators, especially hunters, as the oil shale developed lands would be closed to indiscriminate public entry. Much of the land which changes to modern urban would have previously have been semi-primitive motorized or roaded natural. A change to a setting with high use, smoke plumes, stacks, asphalt roads, large industrial buildings, disposal piles, etc. would be dramatic and very noticeable.

Current Management

Recreation Opportunity Spectrum (ROS) classes would remain narrow, with the most lands in the semi-primitive motorized and roaded natural classifications (see Table IV-2). Recreation Opportunity Spectrum classes in the Current Management Alternative have the least change of any alternative. No non-motorized classes exist to fulfill user needs, but instead the trend is towards a more rural and modern urbanized setting caused by oil and gas and oil shale development. Full potential for recreation goes untapped in this alternative, with user demand for water based recreation and improved hunting and camping conditions unaddressed. The Colorado State Comprehensive Outdoor Recreation Plan priority management recommendations for BLM are met.

Wildlife Alternative

The Wildlife Alternative is most compatible with the objectives of a sound recreation management program. Surface disturbing activities are minimized, while all Colorado State Comprehensive Outdoor Recreation Plan priority recommendations for high need activities are provided for at the highest level (this includes ORV, picnicking, camping and nature study). Additionally, river access would be opened up to meet expected demand. More ORV restrictions and closures occur in this alternative than any other, but this could have positive impact to counteract the negative aspects. While some hunters and ORV enthusiasts may be displaced to adjacent areas, those recreators who desire a non-motorized area would find 14,600 acres in which they can have a semi-primitive non-motorized opportunity. Approximately 9,600 acres of this permanent closure would result from Special Management Area proposals, while the remaining 5,000 acres are from temporary closure in the proposed non-motorized hunting area. On a peak hunting day, as many as 150 people could be forced to abandon their vehicles, and take to hunting on foot or horseback. If they do not desire to do so, they would be displaced to other areas. As many, or perhaps more people could be attracted to these areas for the semi-primitive non-motorized experience.

An additional 14,400 acres of Special Management Areas would have a permanent ORV restriction which would require motorized vehicles to stay on existing designated roads and trails. Some 162,500 acres of seasonally restricted areas would be the result of closing mule deer severe winter range from approximately December to April, allowing access only to those with prior and existing rights or special permit. (Since some motorized vehicles will be allowed access, this figure is not reflected in Table IV-2.) All BLM roads and trails could be closed when weather conditions cause roads to be saturated to three inches. Sensitive watersheds, not yet identified, could have ORV restric-

tions at a future date. See Appendix C for more details. The table shows that the most significant Recreation Opportunity Spectrum changes will occur in the modern urban class and semi-primitive non-motorized classes, with increases in both. The overall change in Recreation Opportunity Spectrum classes is the second lowest, but most desirable of all the alternatives (only Current Management is less, but it does not promote an active recreation program).

Oil and Gas

Impacts are similar to the Current Management Alternative, except 5,000 acres would be closed to motorized vehicles seasonally in the non-motorized hunting area. An additional 5,500 acres would have permanent off-road regulations requiring vehicles to stay on existing roads and trails. All BLM roads and trails could be closed when they be come saturated to three inches during the wet season. See Appendix C for more information. Some 16,100 acres would be inaccessible due to oil shale development. These developments would shift the subject lands into the modern urban class.

Since emphasis would be on oil and gas development, many new roads and well pads would be constructed. This would likely cause semi-primitive motorized areas to drift toward a roaded natural classification. About 5,000 acres in the non-motorized hunting area would change from semi-primitive motorized to semi-primitive non-motorized.

Hunters and ORV enthusiasts would find some 5,000 acres closed seasonally. Similar impacts have been discussed in the Wildlife Alternative. Demand for water based recreation is not met.

As shown in Table IV-2, the most significant shifts would be from semi-primitive motorized to roaded natural and modern urban. Of the BLM lands in the basin, there would be an 8 percent decrease in semi-primitive motorized shifts to roaded natural (up about three percent) and modern urban (up 3 1/2 percent). The semi-primitive non-motorized class increases from a base level of zero up to 5,000 acres, or to 0.8 percent of the BLM ownership. The most apparent change in the basin, considering all public and private lands, would be in the increase of modern urban settings.

Oil Shale Alternative

The Oil Shale Alternative is least compatible with recreation. Mining and processing operations would cause an influx of workers into the region who would increase already heavy hunting levels and cause additional stress to big game herds. The spectrum of recreational opportunity would shift away from the existing semi-primitive motorized class and toward the rural or modern urban class. As shown in Table IV-2, the most significant changes would occur in decreasing semi-primitive motorized opportunity on BLM from 82.6 percent to 74.4 percent of the basin and increasing modern urban on BLM from 0.1 percent to 9.8 percent.

From a recreation program funding standpoint, this would be the most costly alternative to implement, due to the need for additional manpower and the cost of project development.

The inherent character of the basin, which has annually drawn thousands of recreators into the area, would be changed by widespread development and related activities (such as ORV use, traffic, corridors, smoke plumes, etc.). Access to public lands would be restricted on approximately 26,000 acres by operations, mining and disposal activity. Hunting and other recreation use would shift to other areas in the Piceance Basin until the quality of experience (in terms of solitude, crowding, big game herds numbers, safety and success rate) declined to the point where users would select other regions for their desired activities. Impacts and enhancement caused by seasonal road closures in the non-motorized hunting area (5,000 acres) are similar to those in the Wildlife Alternative.

Increased recreational use would require a substantial BLM workload for patrol, information, protection, enhancement and management. The proposed developed ORV area would cause some environmental degradation, including soil erosion, vegetation destruction, noise, dust, fire hazard, wildlife disturbance and livestock displacement. It is possible that the area would be located in an already disturbed site and may actually confine these sorts of impacts to one location which could be more easily controlled and maintained.

Preferred Alternative

The Preferred Alternative would result in an overall improved recreation management situation. This effect is due in part to the diversification of the recreation opportunity spectrum classes and an improved big game herd. Also, creation of a special recreation management area (SRMA) and preparation of a Recreation Area Management Plan would clarify program goals and objectives, and direct energies to much needed programs and site specific projects.

Access would improve along the White River, but conversely, would be restricted on some 16,000 acres developed for oil shale projects. Seasonal ORV restrictions (December to April approximately) would occur on 162,500 acres of crucial wildlife habitat, allowing travel on BLM roads to only those with prior and existing rights. A permanent restriction to existing roads and trails would occur on the Soldier Creek ACEC, totalling some 160 acres. All BLM roads and trails could be closed during wet seasons where roads become saturated to three inches. Creation of a non-motorized hunting area within the special recreation management area, along with other restrictions as discussed, would result in positive and adverse impacts similar to those addressed in the Wildlife Alternative. Adverse impacts would roughly be half of those discussed in the Wildlife Alternative, however. While not determined as of yet, future research and plans in water resources program may result in additional ORV restrictions on sensitive watersheds. Sensitive watersheds have not yet been identified, nor have specific or general restrictions. See Appendix C for further information on ORV closures ad restrictions.

Recreation opportunity spectrum class changes for the Preferred Alternative are shown in Table IV-2. The most significant changes occur within the semi-primitive motorized and modern urban classes. Within semi-primitive motorized, an overall BLM decrease from 82 percent to 76 percent of the planning area would occur, with the major shift to modern urban, which increases (on BLM) from 0 to 4 1/2 percent of the basin.

Since the modern urban areas will be highly visible compared to other classes, the inherent character of the basin would be affected somewhat more than these figures demonstrate.

VISUAL RESOURCES

Protection of visual quality would be achieved through application of the contrast rating system for respective visual resource management classes. Specific measures to reduce contrast include, but are not limited to:

1. Siting in areas of low sensitivity or visibility
2. Application of special design criteria
3. Screening or buffering
4. Camouflage or non-spectral painting
5. Rapid rehabilitation of landforms and vegetation
6. Restriction of surface disturbance
7. Use of visual simulations in impact analysis
8. Special construction techniques

Current Management Alternative

Activity on the public lands under this alternative would continue to degrade the scenic quality of the Piceance Basin. Surface disturbance from oil shale and oil and gas exploration and development, along with right-of-way development (roads, powerlines, pipelines, etc.) would be the primary source of the impacts. Contrast ratings would range in the high teens to high twenties. These impacts, if unmitigated, would be unacceptable for Class III areas for the most part. Impacts in Class IV areas would be acceptable if rated at less than 20 points. If rated higher than 20, they would be unacceptable in Class IV. Many areas of VRM Class II, III and IV would change to Class I, a class reserved for rehabilitation. Only the Wildlife and Preferred Alternatives would be more favorable than the Current Management Alternative to visual resources.

Wildlife Alternative

This alternative would be the most favorable to visual resources. Surface disturbance would be limited, and thus, visual degradation would be minimized. Oil and gas, oil shale, and right-of-way impacts would be the same as in current management, except at a lesser scale. Designation of utility corridors would concentrate visual impacts from those developments where existing facilities already occur, further reducing cumulative impacts to scenic quality.

Oil and Gas Alternative

Areas developed for oil and gas would cause extensive visual degradation as described in current management. Until rehabilitated, these areas would remain in VRM Class V, significantly detracting from the inherent natural beauty of the basin. Scars would be visible from most high points in the basin.

Oil Shale Alternative

Visual impacts would be most extensive under this alternative. Oil shale open pit mining and disposal of any spent shale on the surface would

cause extensive visual degradation, and would change the natural characteristic landscape to a modified landscape. Roads, buildings, and utilities further degrade the landscape. Impacts from other activities, as described in the Current Management Alternative, would probably be even more extensive because mitigating impacts adjacent to highly degraded areas is not practical. Much of the basin could change to VRM Class V. Scars to the landscape would cause high public concern and could be seen from higher points in many parts of the region and most of the Piceance Basin.

Preferred Alternative

Preferred Alternative impacts would be similar to those described for the Current Management Alternative, except that designation of utility corridors would concentrate visual impacts, further reducing cumulative impacts to scenic quality.

SOCIAL AND ECONOMIC

Analysis of the social and economic impacts of the resource management alternatives was based on the assumptions identified in the introduction to this chapter. Construction and operations employment, the residential allocation of the workforce and local purchases by project developers were estimated using data from existing or planned oil shale facilities.

The baseline against which impacts were measured assumes that Federal leasing is most likely to occur in an environment of high energy prices and very active development of northwest Colorado energy resources. Thus, projects producing about 400,000 bbls/day oil shale, all existing and planned coal mines, and ongoing oil and gas development, are included in the baseline.

Although project data were estimated to the year 2015, demographic and economic impacts were only projected through the year 2000, the limit of the economic/demographic model used. Projected impacts to the year 2000 should at least indicate the direction and the comparative impact of the alternatives. Projections beyond 2000 would in any event be highly speculative.

Employment and Income

Direct project employment totals for each alternative are shown in Table IV-3. It is the amount and timing of project employment that largely determines the magnitude of socioeconomic impacts. As Figure IV-2 shows, the Oil Shale Alternative, assuming five leases, would have the greatest project employment and would thus be expected to have the greatest socioeconomic effects. All the alternatives have their greatest employment levels between the years 2005 and 2012 and begin to level off after that.

TABLE IV-3

DIRECT PROJECT EMPLOYMENT PICEANCE BASIN RMP TOTAL EMPLOYMENT FOR CONSTRUCTION AND OPERATIONS BY ALTERNATIVE

Year	Wildlife Alternative			Current Management Alternative			Oil and Gas Alternative			Oil Shale Alternative		
	Construction	Operations	Total	Construction	Operations	Total	Construction	Operations	Total	Construction	Operations	Total
1985	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1986	.....	.....	.....	.....	.....	.....	.....	.....	.....	100	.....	100
1987	.....	.....	.....	.....	.....	.....	.....	.....	.....	200	.....	200
1988	.....	.....	.....	.....	.....	.....	.....	.....	.....	350	.....	350
1989	.....	.....	.....	.....	.....	.....	.....	.....	.....	500	.....	500
1990	.....	.....	.....	.....	.....	.....	.....	.....	.....	800	.....	800
1991	.....	.....	.....	.....	.....	.....	100	.....	100	1,250	25	1,275
1992	.....	.....	.....	.....	.....	.....	200	.....	200	1,650	50	1,700
1993	.....	.....	.....	.....	.....	.....	350	.....	350	2,000	150	2,150
1994	.....	.....	.....	.....	.....	.....	500	.....	500	2,200	300	2,500
1995	.....	.....	.....	.....	.....	.....	800	.....	800	2,550	450	3,000
1996	.....	.....	.....	100	.....	100	1,250	25	1,275	2,950	775	3,725
1997	.....	.....	.....	200	.....	200	1,650	50	1,700	3,200	1,200	4,400
1998	.....	.....	.....	350	.....	350	2,000	150	2,150	2,550	1,550	4,100
1999	.....	.....	.....	500	.....	500	2,200	300	2,500	2,500	1,800	4,300
2000	.....	.....	.....	800	.....	800	2,550	450	3,000	2,750	2,000	4,750
2001	100	.....	100	1,250	25	1,275	2,950	725	3,675	3,300	2,275	5,575

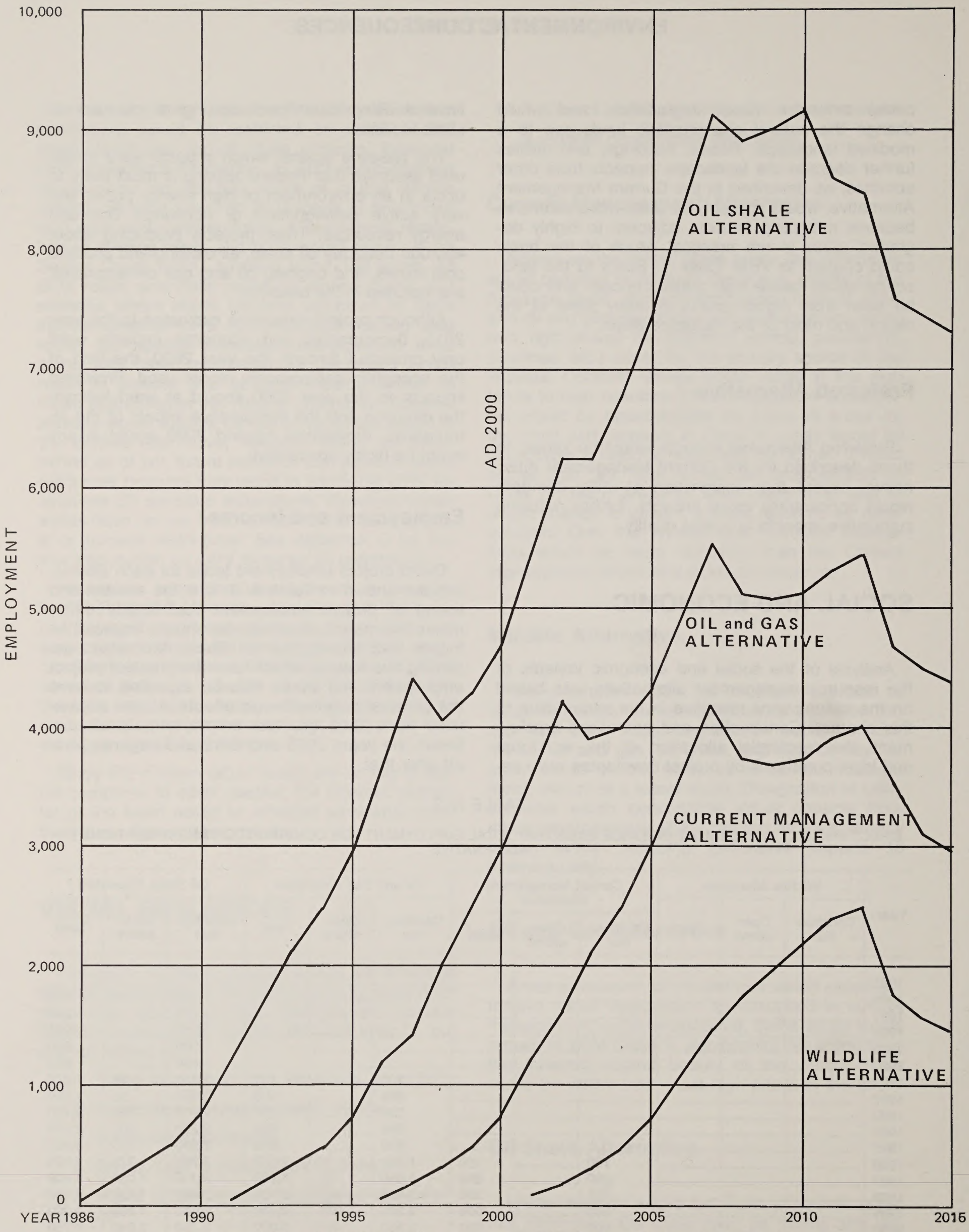


Figure IV-2. Direct Project Employment by Alternative (Construction and Operations) 1986-2015

TABLE IV-3—Continued

DIRECT PROJECT EMPLOYMENT PICEANCE BASIN RMP TOTAL EMPLOYMENT FOR CONSTRUCTION AND OPERATIONS BY ALTERNATIVE

Year	Wildlife Alternative			Current Management Alternative			Oil and Gas Alternative			Oil Shale Alternative		
	Construc-tion	Oper-ations	Total	Construc-tion	Oper-ations	Total	Construc-tion	Oper-ations	Total	Construc-tion	Oper-ations	Total
2002	200	.....	200	1,650	50	1,700	3,200	1,000	4,200	3,700	2,550	6,2 50
2003	350	.....	350	2,000	150	2,150	2,550	1,350	3,900	3,350	2,900	6, 250
2004	500	.....	500	2,200	300	2,500	2,400	1,650	4,050	3,550	3,225	6, 775
2005	800	.....	800	2,550	450	3,000	2,550	1,850	4,400	4,000	3,450	7, 450
2006	1,150	25	1,175	2,850	775	3,625	2,850	2,175	5,025	4,500	3,8 75	8,375
2007	1,450	50	1,500	3,000	1,200	4,200	3,000	2,600	5,600	4,700	4 ,450	9,150
2008	1,650	150	1,800	2,200	1,550	3,750	2,200	2,950	5,150	3,950	4,950	8,900
2009	1,700	300	2,000	1,900	1,800	3,700	1,900	3,200	5,100	3,600	5,450	9,050
2010	1,750	450	2,200	1,750	2,000	3,750	1,750	3,400	5,150	3,300	5,850	9,150
2011	1,700	700	2,400	1,700	2,250	3,950	1,700	3,650	5,350	2,250	6,400	8,650
2012	1,550	950	2,500	1,550	2,500	4,050	1,550	3,900	5,450	1,750	6,800	8,550
2013	550	1,200	1,750	550	2,750	3,300	550	4,150	4,700	550	7,100	7,650
2014	200	1,350	1,550	200	2,900	3,100	200	4,300	4,500	200	7,250	7,450
2015	0	1,400	1,400	0	2,950	2,950	0	4,350	4,350	0	7,300	7,300
2016	.....	1,400	1,400	.....	2,950	2,950	.....	4,350	4,350	.....	7,300	7,300
Full Oper-ation	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

The assumed residential allocation and demographic characteristics of project employees follow closely those evidenced by workers on the C-a and C-b projects. The Rifle area receives the greatest portion of direct project employment, followed by Meeker, with residual numbers in Rangely and Mesa County. Employee wages were placed at $34,400 annually for construction workers and $32,612 for operations employees (1982 dollars). Both levels are considerably higher than wages in other local economic sectors. This difference should draw workers from other sectors and should work toward increasing wages throughout the impacted area.

Projected employment by county for the Current Management, Oil and Gas, and Oil Shale Alternatives is displayed in the lower part of Tables IV-4, IV-5, and IV-6. These figures represent both direct project employment and all the secondary employment brought about by the projects. As noted earlier, projections were made only to the year 2000, so no projections were made for the Wildlife Alternative, in which leasing was assumed not to begin until the year 2000. The Preferred Alternative is also not described, since impacts are estimated to fall somewhere within the range described for the Current Management and Oil and Gas Alternatives.

The employment effects of the Current Management Alternative (Table IV-4) would first be felt in 1996 and 1,430 jobs would be added to the three county area by 2000. This is less than two percent of the total area employment projected for the baseline in the year 2000. When project employment peaks 7 to 12 years later, total employment may have grown by 4,500 to 5,000 jobs, about five percent of the baseline.

TABLE IV-4

CURRENT MANAGEMENT ALTERNATIVE, POPULATION AND EMPLOYMENT IMPACTS TO 2000

	1980	1990	1996			2000		
			Baseline	ALT	Change	Baseline	ALT	Change
POPULATION								
Garfield County	22,514	54,006	62,331	62,442	111	63,027	63,916	889
New Castle	560	1,363	1,545	1,548	3	1,589	1,614	25
Parachute/Battlement Mesa	752	10,690	14,330	14,337	7	14,247	14,306	59
Rifle	3,405	12,119	13,146	13,240	94	13,445	14,204	759
Silt	916	2,010	2,397	2,403	6	2,473	2,525	52
Mesa County	81,530	110,254	119,529	119,529	--	118,739	118,739	--

TABLE IV-4—Continued

CURRENT MANAGEMENT ALTERNATIVE, POPULATION AND EMPLOYMENT IMPACTS TO 2000

	1980	1990	1996			2000		
			Baseline	ALT	Change	Baseline	ALT	Change
DeBeque	278	489	879	879	--	783	783	--
Fruita	2,810	4,011	4,883	4,883	--	4,360	4,360	--
Grand Junction	46,143	63,670	68,558	68,560	2	68,282	68,285	3
Palisade	1,550	2,476	2,865	2,865	--	2,802	2,802	--
Rio Blanco County	6,255	13,949	12,451	12,521	70	13,203	13,773	570
Meeker	2,370	6,332	5,706	5,767	61	6,113	6,596	483
Rangely	2,125	4,789	4,452	4,461	9	4,712	4,778	66
Three County Total	110,299	178,211	194,312	194,493	181	194,969	196,428	1,459
EMPLOYMENT								
Garfield County								
Total	11,446	27,259	30,625	30,724	99	31,520	32,369	849
Mining	608	5,413	8,466	8,466	--	9,501	9,501	--
Construction	1,067	4,530	3,407	3,477	70	2,598	3,163	565
Mesa County								
Total	38,387	53,761	59,824	59,852	28	58,558	58,830	272
Mining	2,357	4,447	5,693	5,693	--	6,121	6,121	--
Constuction	2,740	4,851	6,901	6,902	1	5,208	5,218	10
Rio Blanco County								
Total	4,288	8,604	7,196	7,232	36	7,927	8,236	309
Mining	1,761	2,989	3,452	3,452	--	3,977	3,977	--
Construction	179	1,825	193	223	30	183	419	236
Three County Total	54,121	89,624	97,645	97,808	163	98,005	99,435	1,430

The Oil and Gas Alternative (Table IV-5) assumes leasing at an earlier date, 1990, and so has a more sizeable effect by the year 2000, adding 5,730 direct and secondary jobs to the area economy (about six percent). Most of the increase, about 60 percent, would be located in Garfield County, with Mesa and Rio Blanco Counties each receiving about 20 percent.

TABLE IV-5

OIL AND GAS ALTERNATIVE POPULATION AND EMPLOYMENT IMPACTS TO 2000

	1980	1990	1991			1995			2000		
			Baseline	ALT	Change	Baseline	ALT	Change	Baseline	ALT	Change
POPULATION											
Garfield County	22,514	54,006	54,787	54,981	194	62,843	64,057	1,214	63,027	68 ,476	5,449
New Castle	560	1,363	1,381	1,386	5	1,532	1,566	34	1,589	1,730	141
Parachute/Battlement Mesa	752	10,690	11,474	11,511	35	14,346	14,488	142	14,247	15,085	83 8
Rifle	3,405	12,119	11,253	11,381	128	13,782	14,682	900	13,445	17 ,157	3,712
Silt	916	2,010	2,020	2,030	10	2,376	2,439	63	2,473	2,729	256
Mesa County	81,530	110,254	111,862	111,862	--	119,011	119,260	249	118,739	119,008	269
DeBeque	278	489	617	617	--	904	908	4	783	787	4
Fruita	2,810	4,011	4,217	4,218	1	4,856	4,872	16	4,360	4,377	17
Grand Junction	46,143	63,670	64,382	64,384	2	68,242	68,386	144	68,282	68,438	156
Palisade	1,550	2,476	2,570	2,570	--	2,869	2,884	15	2,802	2,818	16
Rio Blanco County	6,255	13,949	12,956	13,003	47	13,630	14,137	507	13,203	15,328	2,125
Meeker	2,370	6,332	5,830	5,875	45	6,276	6,719	443	6,113	7,888	1,775
Rangely	2,125	4,789	4,716	4,719	3	4,684	4,742	58	4,712	4,994	28 2
Three County Total	110,299	178,211	179,605	179,846	241	195,484	197,454	1,970	194,9 69	202,812	7,843
EMPLOYMENT											
Garfield County											
Total	11,446	27,259	28,180	28,281	101	31,701	32,394	693	31,520	34,903	3, 383
Mining	608	5,413	5,750	5,750	--	8,220	8,220	--	9,501	9,834	333
Construction	1,067	4,530	4,982	5,052	70	4,472	5,033	561	2,598	4, 428	1,830

TABLE IV-5—Continued

OIL AND GAS ALTERNATIVE POPULATION AND EMPLOYMENT IMPACTS TO 2000

	1980	1990	1991			1995			2000		
			Baseline	ALT	Change	Baseline	ALT	Change	Baseline	ALT	Change
Mesa County											
Total	38,387	53,761	55,421	55,453	32	60,020	60,252	232	58,558	59,735	1,1 77
Mining	2,357	4,447	4,544	4,544	--	5,577	5,577	--	6,121	6,121	--
Construction	2,740	4,851	5,602	5,605	3	7,040	7,061	21	5,208	5,28 2	74
Rio Blanco County											
Total	4,288	8,604	7,778	7,814	36	8,067	8,376	309	7,927	9,097	1, 170
Mining	1,761	2,989	3,075	3,075	--	3,376	3,376	--	3,977	4,094	11 7
Construction	179	1,825	1,032	1,061	29	950	1,186	236	183	938	755
Three County Total	54,121	89,624	91,379	91,548	169	99,788	101,022	1,234	98,005	10 3,735	5,730

Because the first lease under the Oil Shale Alternative would begin in 1985, employment effects by the year 2000 would be substantial. Almost 10 percent, 9,346 employees, would have been added to the three county total. Garfield County would again receive about 60 percent of the employment, with Mesa and Rio Blanco Counties splitting the remainder. This addition would worsen a condition projected to occur under baseline assumptions -- a very heavy reliance on the energy-minerals based mining and construction sectors. The proportion of employment in these two sectors would increase from 52 to 56 percent in Rio Blanco County and from 38 to 42 percent in Garfield County. This kind of dependence makes the local economy extremely vulnerable to a slowdown in development of energy minerals.

Personal income increases brought about by expanded Federal oil shale development would be somewhat greater than the employment increases because the direct project employees would have relatively high wages. While income increases brought about by the Current Management Alternative in the year 2000 would be marginal, the Oil and Gas Alternative would increase personal income in Garfield and Rio Blanco Counties by 12 and 14 percent, respectively. The Oil Shale Alternative would increase income in those counties by 19 and 23 percent.

Population

Baseline and alternative population projections are shown on the upper portion of Tables IV-4, IV-5 and IV-6. While no projections were made for the Wildlife Alternative, it can be estimated that by the year 2015, that alternative would add about 5,400 people to the area population, perhaps a two percent increase. The bulk of population impacts resulting from the other alternatives is also expected to occur after 2000. However, projected change by 2000 reveals the direction, location and comparative magnitude of those changes.

The Current Management Alternative (Table IV-4) would have a population impact in the year 2000 of about 1,500 additional people, only slightly larger than the employment impact because that early in the first project's development (the fifth year), the greater part of employment growth would be made up of construction workers, most of whom would be single or married without family. Year 2015 population growth under this alternative could be 11,000 people, five percent of the baseline total. Rifle and Meeker would receive the greatest amount of growth.

Leases under the Oil and Gas Alternative (Table IV-5) would increase the population of the study area by 7,843 in 2000. By 2015, perhaps 18,000 people could be added to the population base. This alternative would cause Rifle's year 2000 population to be 3,700 higher than the baseline (28 percent). Other towns in the New Castle to Battlement Mesa corridor would have populations 6 to 11 percent higher than the baseline. Meeker's population would be 1,775 greater than the baseline (29 percent). Grand Junction and Mesa County would receive growth of insignificant magnitude relative to the year 2000 population base.

The Oil Shale Alternative (Table IV-6) would of course have the greatest population impact, increasing the three-county area population to 210,077, a difference of 15,708 more than the year 2000 baseline projection. By the year 2015, population could be 28,000 greater due to this alternative. Rifle's population could increase by 5,994 (45 percent). Other towns in the Colorado River Corridor could be 10 to 45 percent larger. Meeker's baseline population of 6,113 in 2000 is projected to increase by 2,704 (44 percent over the baseline).

TABLE IV-6

OIL SHALE ALTERNATIVE POPULATION AND EMPLOYMENT IMPACTS TO 2000

	1980	1986			1990			1995			2000		
		Baseline	ALT	Change	Baseline	ALT	Change	Baseline	ALT	Change	Baseline	ALT	Change
POPULATION													
Garfield County	22,514	47,169	47,296	127	54,006	55,365	1,359	62,843	68,943	6, 100	63,027	72,943	9,916
New Castle	560	1,170	1,173	3	1,363	1,400	37	1,532	1,699	167	1,589	1,84 5	256
Parachute/ Battlement Mesa	752	10,417	10,433	16	10,690	10,856	166	14,346	15,515	1,169	14, 247	16,259	2,012
Rifle	3,405	8,333	8,430	97	12,119	13,069	950	13,782	17,631	3,849	13,445	19,439	5,994
Silt	916	1,742	1,749	7	2,010	2,081	71	2,376	2,669	293	2,473	2, 921	448
Mesa County	81,530	104,279	104,340	61	110,254	110,511	257	119,011	120,645	1,634	118,739	120,497	1,758
DeBeque	278	562	563	1	489	491	2	904	919	15	783	800	17
Fruita	2,810	4,137	4,141	4	4,011	4,024	13	4,856	4,960	104	4,360	4,471	111
Grand Junction	46,143	59,883	59,924	41	63,670	63,835	165	68,242	69,203	961	68,282	69,315	1,033
Palisade	1,550	2,321	2,323	2	2,476	2,486	10	2,869	2,962	93	2,80 2	2,902	100
Rio Blanco County	6,255	11,586	11,655	69	13,949	14,519	570	13,630	15,659	2,029	13,203	16,637	3,434
Meeker	2,370	4,218	4,278	60	6,332	6,802	470	6,276	7,975	1,699	6 ,113	8,817	2,704
Rangely	2,125	3,503	3,511	8	4,789	4,870	81	4,684	4,958	274	4,71 2	5,277	565
Three County Total	110,299	163,034	163,291	257	178,209	180,395	2,186	195,484	205,247	9, 763	194,969	210,077	15,108
EMPLOYMENT													
Garfield County Total	11,446	24,596	24,666	70	27,259	28,126	867	31,701	35,203	3, 502	31,520	37,158	5,638
Mining	608	3,617	3,617	--	5,413	5,413	--	8,220	8,553	333	9,501	10,981	1 ,480
Construction	1,067	5,181	5,250	69	4,530	5,101	571	4,472	6,314	1, 842	2,598	4,618	2,020
Mesa County Total	38,387	52,019	52,048	29	53,761	54,063	302	60,020	61,334	1, 314	58,558	60,426	1,868
Mining	2,357	3,083	3,083	--	4,447	4,447	--	5,577	5,577	--	6,121	6,121	--
Construction	2,740	6,734	6,736	2	4,851	4,876	25	7,040	7,136	96	5,208	5,316	10 8
Rio Blanco County Total	4,288	7,256	7,292	36	8,604	8,913	309	8,067	9,213	1,146	7, 927	9,767	1,840
Mining	1,761	2,350	2,350	--	2,989	2,989	--	3,376	3,493	117	3,97 7	4,497	520
Construction	179	1,563	1,593	30	1,825	2,060	235	950	1,704	754	1 83	1,007	824
Three County Total	54,121	83,871	84,006	135	89,624	91,102	1,478	99,788	105,750	5, 962	98,005	107,351	9,346

While population would increase under all alternatives (including the Wildlife Alternative), the growth would not necessarily be detrimental. The baseline assumed in this analysis would, in fact, result in a slowdown of population growth, and economic stagnation by 2000. The projects evaluated here could have a beneficial effect to the extent their impacts were timely and moderate. The effects of annual growth rates in area towns are discussed below (under Social Growth Impacts).

Infrastructure and Fiscal Impacts

Given the hypothetical nature of this analysis, projections of impacts on communities' physical and social service infrastructure would not be meaningful. Moreover, since the heaviest impacts would occur after the turn of the century (beyond the limit of the economic/demographic model used), only very rough impact estimates would be possible. When specific tracts have been selected for leasing, the site-specific evaluations could include a meaningful assessment of infrastructure impact. At this point, it is clear that only the Oil Shale Alternative would require substantial infrastructure development before the year 2000. When infrastructure development is to be required, the Meeker area and the Colorado River Corridor between New Castle and Parachute would be the areas most in need of improvements.

Similarly, estimates of direct and secondary public revenues generated by these alternatives are beyond the scope of this analysis. A sound fiscal impact evaluation would require more reliable project specifications and population estimates than are currently available. It is possible, however, to

suggest the magnitude of Federal lease royalty payments that may be available from projects of the scale assumed in these alternatives. A 37,000 bbls/day shale oil project could be expected to yield about 22 million dollars annually in lease royalty payments. This assumes a western Colorado oil price of 45 dollars per barrel, 330 days of production per year, and a royalty rate equivalent to about four percent of gross value. This would assume a permanent leasing royalty rate which is higher than the royalty rate for the existing prototype leases.

Under current law, 50 percent of lease royalty payments are returned to the producing state to be used to address the social and economic impacts of mineral production. The 11 million dollars Colorado could receive for each project is roughly 30 percent of what Colorado currently receives annually as its share of Federal royalty payments for production of all minerals. So three projects of the scale assumed here would almost double Colorado's current royalty receipts.

Social Growth Impacts

Social impacts would occur principally from three sources in all alternatives: the type, rapidity and degree of energy resource development, the demographic changes brought about by the incoming work force, and the degree of cultural differences between the new people and the existing population.

Though oil, gas and coal are common to the study area, oil shale is the single most significant resource in the Piceance Basin. The uncertainty and costliness of oil shale technology in the near past and for the foreseeable future has continued the historical patterns of boom expectations and bust conditions. Its potential population impacts are erratic at best and at worst could not be predicted at all.

Table IV-7 is an effort to illustrate the nature of such fluctuations as they would most likely occur for Meeker, Rangely and Rifle, based upon the population assumptions already discussed. Because of the large population growth assumed for the baseline, a spillover of persons to other nearby communities would be likely. Similar calculations for four other towns -- Parachute/Battlement Mesa, Silt, New Castle and Glenwood Springs -- are provided in Appendix A, Table A-2. Grand Junction would be affected also, but it is believed that this city is now large enough and well-enough oriented to energy development that any additional social impacts would be much less severe than in the smaller communities.

Table IV-7 shows, first, the baseline population for the three communities closest to the Piceance Basin. Rifle (about 70 percent) and Meeker (about 25 percent) in the recent past have received most of Piceance Basin oil shale-related population, and are expected to continue doing so. Rangely is close by but, isolated by lack of a good direct road either to the basin or to a major city, has drawn only a few workers (about two percent).

TABLE IV-7

PICEANCE BASIN TOTAL POPULATION EFFCTS 1985-2000, ALL ALTERNATIVES

Year	Baseline	% Chg Bet. yrs.	Wildlife Alternative	Current Management Alternative					Oil and Gas Alternative					Oil Shale Alternative				
				Pop. Added	Total	% Chg Bet. yrs.	% Dif. Altern. Base-line	% Add. Base-line	Pop. Added	Total	% Chg Bet. yrs.	% Dif. Altern. Base-line	% Add. Base-line	Pop. Added	Total	% Chg Bet. yrs.	% Dif. Altern. Base-line	% Add. Base-line
MEEKER																		
1980	2,370	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1985	3,567	.....	No effects before year 2000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,567	.....	.....	.....
1986	4,218	+18	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	60	4,278	+20	2	1
1987	5,724	+36	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	126	5,850	+37	1	2
1988	6,035	+5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	211	6,246	+7	2	4
1989	6,485	+7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	305	6,790	+9	2	5
1990	6,332	-2	.....	.....	.....	.....	.....	.....	.....	6,332	.....	.....	.....	470	6,802	+0	2	7
1991	5,830	-9	.....	.....	.....	.....	.....	.....	45	5,875	-8	1	1	673	6,503	-5	4	12
1992	5,570	-5	.....	.....	.....	.....	.....	.....	120	5,690	-3	2	2	923	6,493	-0	5	17
1993	5,809	+4	.....	.....	.....	.....	.....	.....	189	5,998	+5	1	3	1,101	6,910	+6	2	19
1994	6,281	+8	.....	.....	.....	.....	.....	.....	306	6,587	+10	2	5	1,524	7,805	+13	5	24
1995	6,276	-0	.....	.....	6,276	.....	.....	.....	443	6,719	+2	2	7	1,699	7,975	+2	2	27
1996	5,706	-10	.....	61	5,767	-8	1	1	800	6,506	-3	7	14	2,199	7,9 05	-1	9	39
1997	5,769	+1	.....	106	5,875	+2	1	2	989	6,758	+4	3	17	2,338	8,1 07	+3	2	41
1998	5,834	+1	.....	174	6,008	+2	1	3	1,184	7,018	+4	3	20	2,275	8 ,109	+0	1	39
1990	5,936	+2	.....	310	6,246	+4	2	5	1,498	7,434	+6	4	25	2,458	8 ,394	+4	2	41
2000	6,113	+3	.....	483	6,596	+6	3	8	1,775	7,888	+6	3	29	2,704	8 ,817	+5	2	44
RIFLE																		
1980	3,405	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1985	7,994	.....	No effects before year 2000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7,994	.....	.....	.....
1986	8,333	+4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	97	8,430	+5	1	1

TABLE IV-7—Continued

PICEANCE BASIN TOTAL POPULATION EFFCTS 1985-2000, ALL ALTERNATIVES

Year	Baseline	% Chg Bet. yrs.	Wildlife Alternative	Current Management Alternative					Oil and Gas Alternative					Oil Shale Alternative				
				Pop. Added	Total	% Chg Bet. yrs.	% Dif. Altern. Base-line	% Add. Base-line	Pop. Added	Total	% Chg Bet. yrs.	% Dif. Altern. Base-line	% Add. Base-line	Pop. Added	Total	% Chg Bet. yrs.	% Dif. Altern. Base-line	% Add. Base-line
1987	9,965	+20												256	10,222	+21	1	3
1988	11,703	+17												468	12,171	+19	2	4
1989	12,944	+11												663	13,607	+12	1	5
1990	12,119	-7								12,119				950	13,069	-4	3	8
1991	11,253	-8							128	11,381	-6	2	1	1,708	12,961	-1	7	15
1992	12,000	+7							250	12,250	+8	1	2	2,224	14,224	+10	3	19
1993	14,200	+12							467	14,667	+20	8	3	2,936	17,136	+20	8	21
1994	13,923	-2							612	14,535	-1	1	4	3,400	17,323	+1	3	24
1995	13,782	-1			13,782				900	14,682	+1	2	7	3,849	17,631	+2	3	28
1996	13,147	-5		93	13,240	-4	1	1	1,328	14,475	-1	4	10	4,258	17,405	-1	4	32
1997	13,288	+1		189	13,477	+2	1	1	1,715	15,003	+4	3	13	5,103	18,391	+6	5	38
1998	13,368	+1		331	13,699	+2	1	2	2,437	15,805	+5	4	18	5,041	18,409	+0	-1	38
1990	13,374	+0		474	13,848	+1	1	4	2,880	16,254	+3	3	22	5,215	18,589	+1	1	39
2000	13,445	+1		759	14,204	+3	2	6	3,712	17,157	+6	5	28	5,994	19,439	+5	4	45
RANGELY																		
1980	2,125																	
1985	3,243		No effects before year 2000												3,243			
1986	3,503	+8												8	3,511	+8	0	0
1987	4,021	+15												15	4,036	+15	0	0
1988	4,365	+9												35	4,400	+9	0	1
1989	4,590	+5												48	4,638	+5	0	1
1990	4,789	+4								4,789				81	4,870	+5	1	2
1991	4,716	-2							3	4,719	-1	1	0	97	4,813	-1	1	2
1992	4,716	0							24	4,740	+0	0	1	152	4,868	+1	1	3
1993	4,697	-0							29	4,726	-0	0	1	166	4,863	-0	0	4
1994	4,702	+0							49	4,751	+1	1	1	261	4,963	+2	1	6
1995	4,684	-0			4,684				58	4,742	-0	0	1	274	4,958	-0	0	6
1996	4,452	-5		9	4,461	-5	0	0	133	4,585	-3	2	3	410	4,862	- 2	3	9
1997	4,485	+1		12	4,497	+1	0	0	140	4,630	+1	0	3	421	4,906	+1	0	9
1998	4,541	+1		16	4,557	+1	0	0	168	4,709	+2	1	4	476	5,017	+2	1	10
1990	4,611	+2		47	4,658	+2	0	1	245	4,856	+3	1	5	529	5,140	+2	0	11
2000	4,712	+2		66	4,778	+3	1	1	282	4,994	+3	1	6	565	5,277	+3	1	12

Notable about the baseline is its considerable fluctuations year by year ("percent change between years" in Table IV-7). For example, Rifle would jump from a four percent annual growth rate between 1985 and 1986, to 20 percent between 1986 and 1987, then would fall abruptly from an 11 percent growth rate in 1989 to a 7 percent loss in 1990 -- only to bounce back to 12 percent growth by 1993. While these figures are only illustrative, as explained earlier, fluctuations of this magnitude would undoubtedly occur if oil shale does finally "go" in the region.

Such wide swings in baseline growth would, of course, guide similar variations in growth rates from the leasing alternatives themselves. These are given as "percent change between years" for each alternative.

Two further percentage comparisons are shown in Table IV-7 which help clarify the relationship between baseline and leasing impacts. The "percent difference, alternative-baseline" compares the annual growth rates of the baseline with the alternatives. Except for Rifle in 1998 (and instances in New Castle and Glenwood Springs in Appendix A, Table A-2), all years for all alternatives show higher population for the alternatives than for the baseline. Sometimes (e.g., Meeker, Oil and Gas Alternative, 1996) the effect of leasing would be to reduce the population decline rate for a given year and thus would help to ameliorate *slump* (in the Meeker example from -10 percent to -3 percent, a difference of 7 percent). In other cases, an already extreme annual jump would become even more extreme (e.g. Rifle, Oil Shale Alternative, 1993, from 18 percent to 20 percent, a net difference of 2 percent). Thus, the actual effects of a particular town, year and alternative could be either helpful or harmful, depending on baseline fluctuations.

The last percent shown, "percent add baseline", is often used by persons concerned with rapid growth to prove that devastating impacts from a project can occur because the additional project population increase ("population added" column) is so great relative to the corresponding baseline population total for that year. For example, 5,994 new persons in Rifle, Oil Shale Alternative, in 2000, is 45 percent of the baseline population for that year, which might be mistaken as implying an almost 50 percent increase for the year. But while a single percentage of this sort is appropriately used as a

general statement of leasing impacts, to consider it an indication of annual growth is an incorrect comparison. The population would not in reality increase from the baseline to that much greater a number in that one year. The correct comparison is the growth rates of the baseline and alternative for that year. Thus, for Rifle, the baseline in this case would have grown one percent from that of 1999, where the alternative would have produced a five percent increase over the prior year of the alternative, a net difference of four percent. The actual effect of the alternative would thus be a somewhat exaggerated growth progression, the importance of which would depend upon the characteristics of baseline growth.

As noted in Table IV-7, the Wildlife Alternative would produce no social impacts prior to the year 2000.

To summarize, in evaluating social impacts of the alternatives, the annual growth rate signifies the degree of social impact, and the difference in annual growth rate signifies the proportion of this intensity caused by the alternatives.

Such erratic and sudden growth and decline curves would have important social consequences. Two sets of lives would be affected.

First would be those workers and families moving in and out either as employed construction transients whose jobs have been completed, or as movers in and out seeking employment. Second would be permanent residents, either construction workers able to move from job to job locally, operations newcomers, or longtime residents.

Transients for whatever reason (by choice or necessity) tend to remain on the fringes of a community and often of the general society as well. Stable residents tend to believe transiency is always a choice, and often believe transients are unstable or irresponsible. Transiency is also often (but not always) concentrated among the young, single males or young families, whose interests and needs vary from those of others in the community. So, in addition to their special needs (such as for different types of recreation), transients frequently are rejected and kept isolated from the host community. For families moving about from necessity rather than from choice, such rejection may be added to already-existing anxieties over unemployment and other problems, making these families especially vulnerable to such things as family violence, mental depression or alcoholism, both for parents and for children facing hostilities in school. Transient singles or families have little structural impact on a community beyond their contacts with recreational facilities, law enforcement or social services.

Problems of permanent newcomers and longtime residents differ from those of transients and of each other. Permanent newcomers expect and are expected to become part of the community. They play the role initially of strangers who are potential friends and responsible citizens. Typically, rural communities accept quickly those newcomers who fulfill expectations and obviously like and want to be involved, though wary of newcomers who are culturally different, less outgoing, or slower to become involved. Thus, isolation is to some degree at least a matter of personal inclination or choice. Permanent newcomers have core effects -- they participate in schools, churches, voluntary organizations and enter the power and other social structures through these and through local government participation.

Permanent newcomers also have different housing and service needs from transients, and communities may be hard pressed to furnish an appropriate housing mix from trailer parks, to apartments and other multiple units, to single family housing. This is a particularly touchy problem when there are rapid and deep fluctuations in population.

Longtime residents have fixed loyalties and comfortable interactional patterns in the community as it is, and tend to resist rapid change, especially if it involves much transiency. Since the first and often the largest numbers to enter are usually the transient construction workers, initial local perceptions are likely to be more negative than would occur if growth were gradual and initial contacts were with permanent newcomers. In northwest Colorado, much of this type of social adjustment will already have occurred, since oil shale and other forms of energy development have already taken place and no community in the study area is unaware of these problems.

In Meeker, for instance, the discussion as of late 1983 is how to fill up the vacant housing and whether to have temporary camps for single workers near projects in the Piceance Basin, or build facilities in town. For this region, recent boom-bust experiences with oil shale have produced a great caution about providing costly advance expansions of services and facilities. Traditional rural lifeways have been and will continue to be eroded as new norms and social class adjustments evolve. The social power and prominence of ranchers has gradually diminished as commercial and energy-related families have gained influence. A growing cultural diversity has widened the range of both activities and tolerance for differences. Most of the towns have developed social and economic connections over a much greater geographic area as new persons with outside social ties, and such enterprises as chain franchise stores, enter the

region. Substantial rapid growth will inevitably also force official functions such as politics, planning, governing, etc., into more and more formal procedures and organizational structures. Changes such as these are often called *urbanization*, though the term is loosely used.

All of the above social changes will be more difficult in the face of the sudden sharp fluctuations in annual growth/decline rates. As already noted, the alternatives would help reduce declines but would amplify rises in these rates, so would have alternating positive and negative impacts in many instances.

With respect to the intensity of social impacts, annual growth rates from 5 to 15 percent are considered by experts to become increasingly unmanageable, especially if sustained over a period of years. Anything over 15 percent growth in one year tends to produce substantial social structural breakdown, even if many *boom* adjustments have already occurred. The rapid fluctuations predicted would cloud the picture greatly.

Finally, even uncertain predictions cannot be extended beyond the year 2000 for baseline growth, and as noted earlier, all of the most drastic population growth from the management alternatives would occur between 2000 and 2015, when all projects would reach full operation. Therefore, these years would probably be years of very great negative social impacts.

Demographic Impacts

Figures IV-3 and IV-4 visually describe the two most important demographic impacts of the various alternatives.

First, workers in secondary employment generally will be quite similar to the existing population in social characteristics. Moreover, they will also cause few demographic changes (and they are not included in Figure IV-3).

The inflow of construction workers, and a substantial proportion of the operations force will consist of highly paid skilled men, with a higher-than-usual proportion of singles. These facts would cause shifts in the income and employment patterns. Persons of working class interests and backgrounds combined with higher class incomes are in situations of status inconsistency which are reflected in spending, recreation, cultural interests and other social behavior.

Figure IV-3 shows the relative proportions of construction and permanent workers as they change over the Oil Shale Alternative, for the whole region to 2015.

Figure IV-4 portrays, through a set of comparative population pyramids, how the age and sex distributions would shift for Rangely, Meeker and Rifle as the result of alternatives and baselines combined for the year 2000. In all three cases, the 1980 actual population (first pyramid) showed somewhat greater proportions of males except in the oldest age group, and a somewhat greater than average proportion of older people. As the result of baseline and project growth combined (baseline growth is assumed to be due largely to similar energy development), the oldest age category would tend to shrink and include more men. The principal working age groups would grow, with those 40-64 increasing slightly more as the permanent work force ages. In all cases, the proportion of children and youth increases.

The implications of these demographic shifts for changes in school enrollments, recreational needs, family versus elderly social services needs, etc., are obvious. The differences also imply structural changes in informal organizations, formal services delivery, and social power.

Attitudes, Issues and Decision Choices

Potential Piceance Basin oil shale development is an issue of local, state, regional and national significance, stretching from congressional and presidential policy, to Colorado's east-west slope water management, to the fears of local residents regarding threats to air quality and traditional lifeways. It is also an economic issue at every level, tied to world oil prices, the state of oil shale technology, and the local job markets.

In general, local people seem to want the economic advantages of exporting oil shale resources, but do not want the negative social and environmental consequences of massive development. National polls indicate a strong concern for air and water quality, a defined need for national energy self-sufficiency, and an optimistic belief that both are possible. Persons living in the immediate vicinity of large scale development appear to hope to balance moderate, manageable growth in such a way as to have the economic gains without the associated costs. In reality, such a balance may be impossible to attain.

Two other important social considerations have particularly important implications for BLM land use planning.

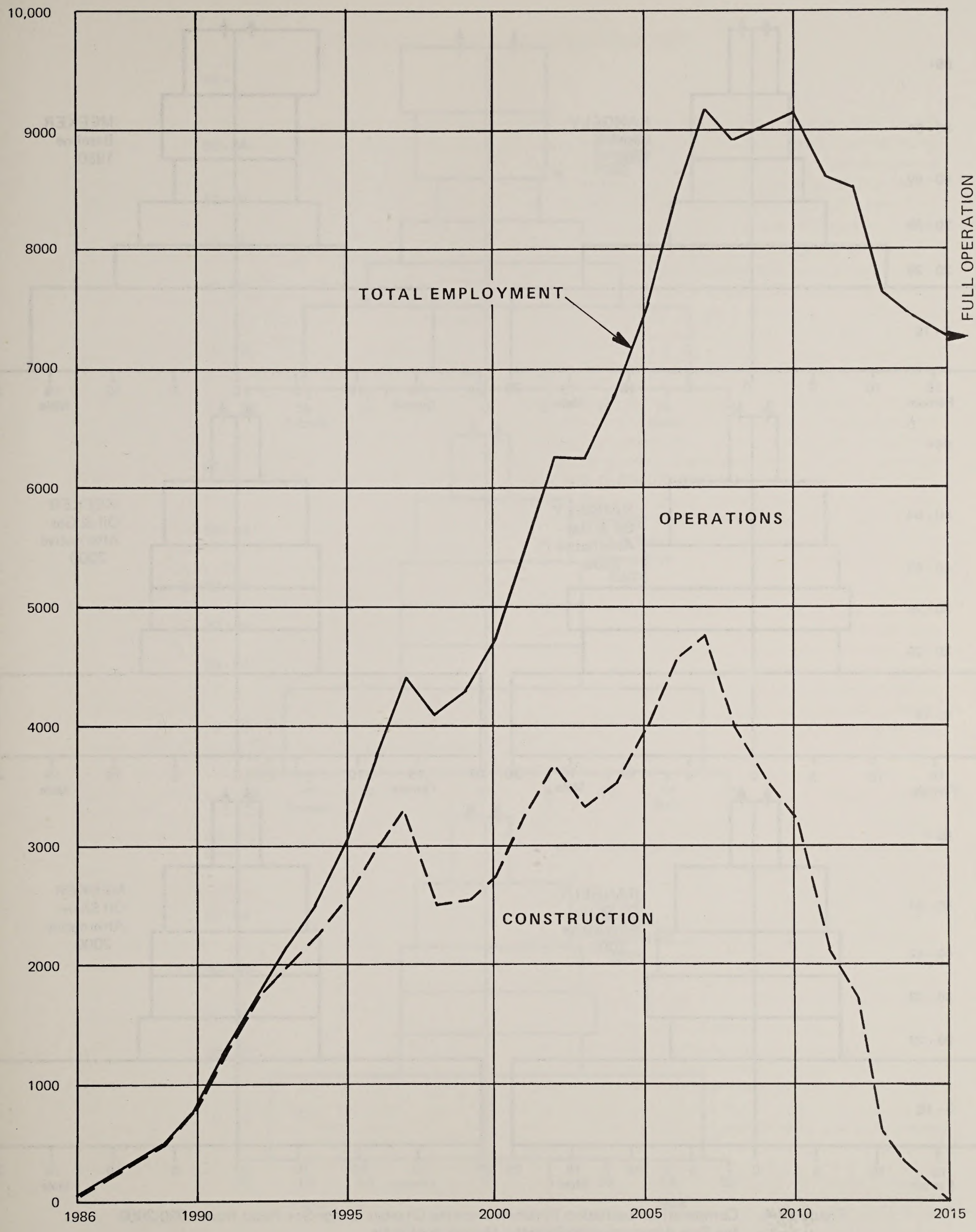
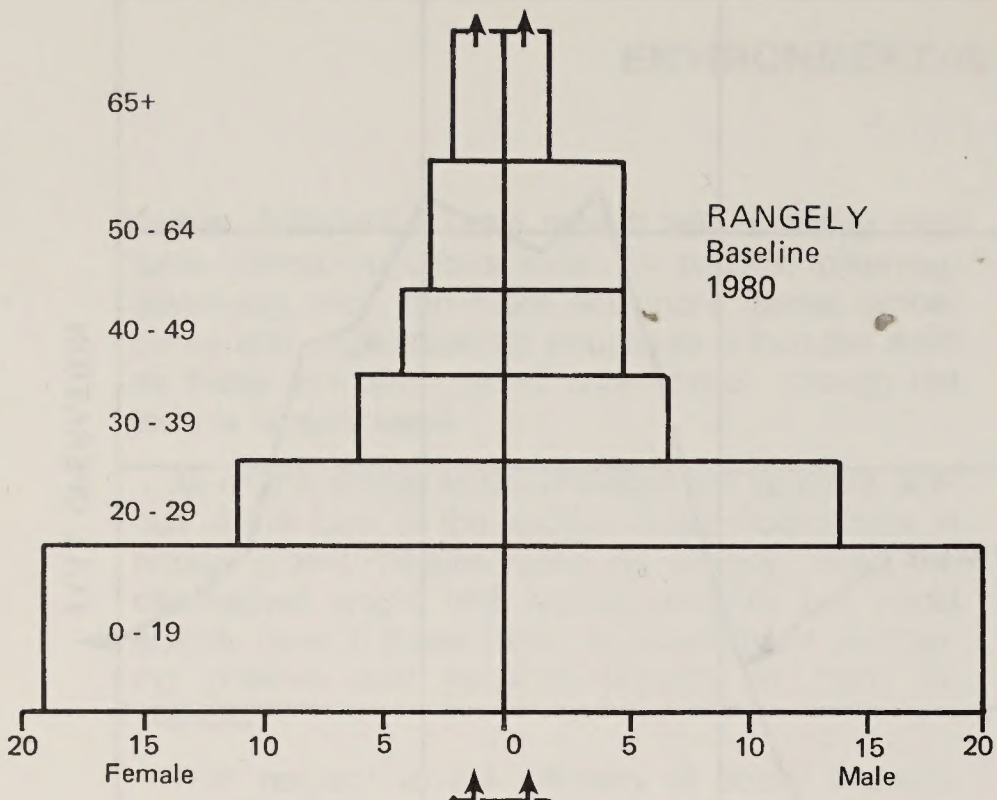
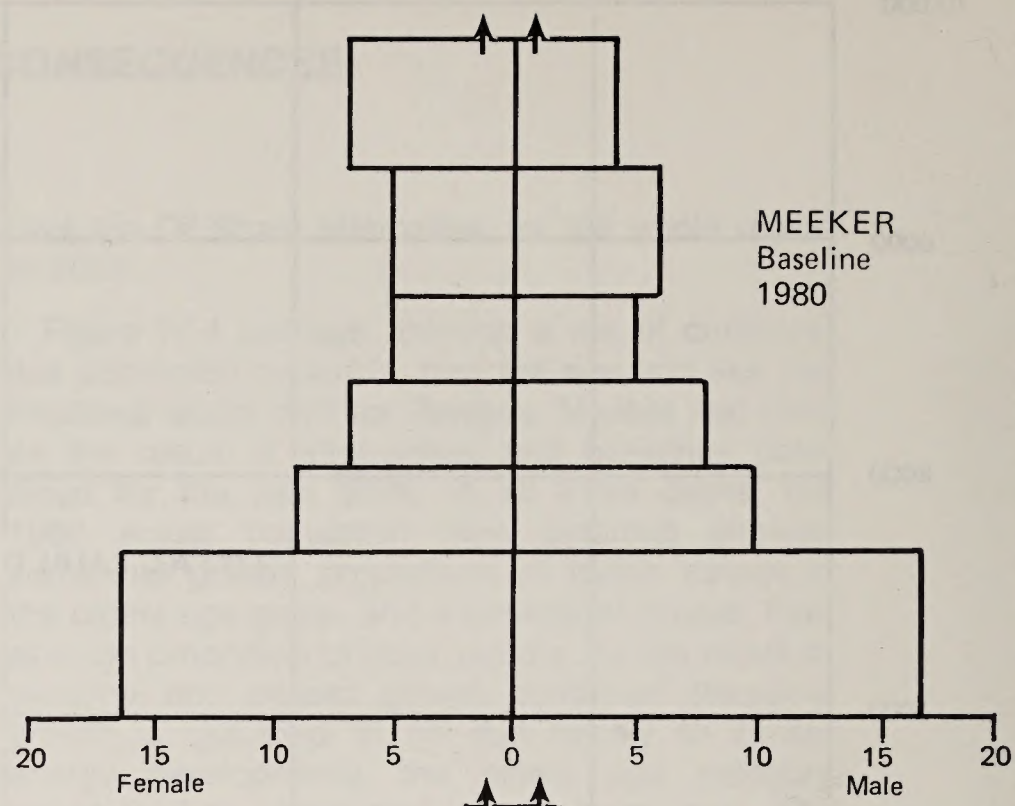
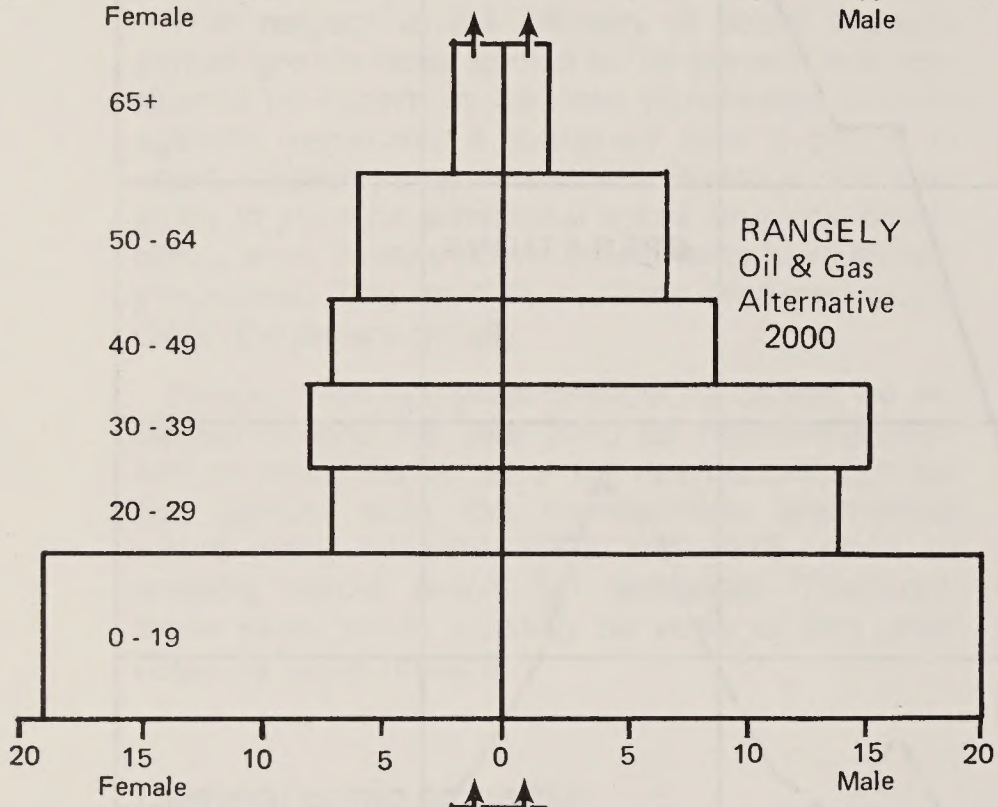
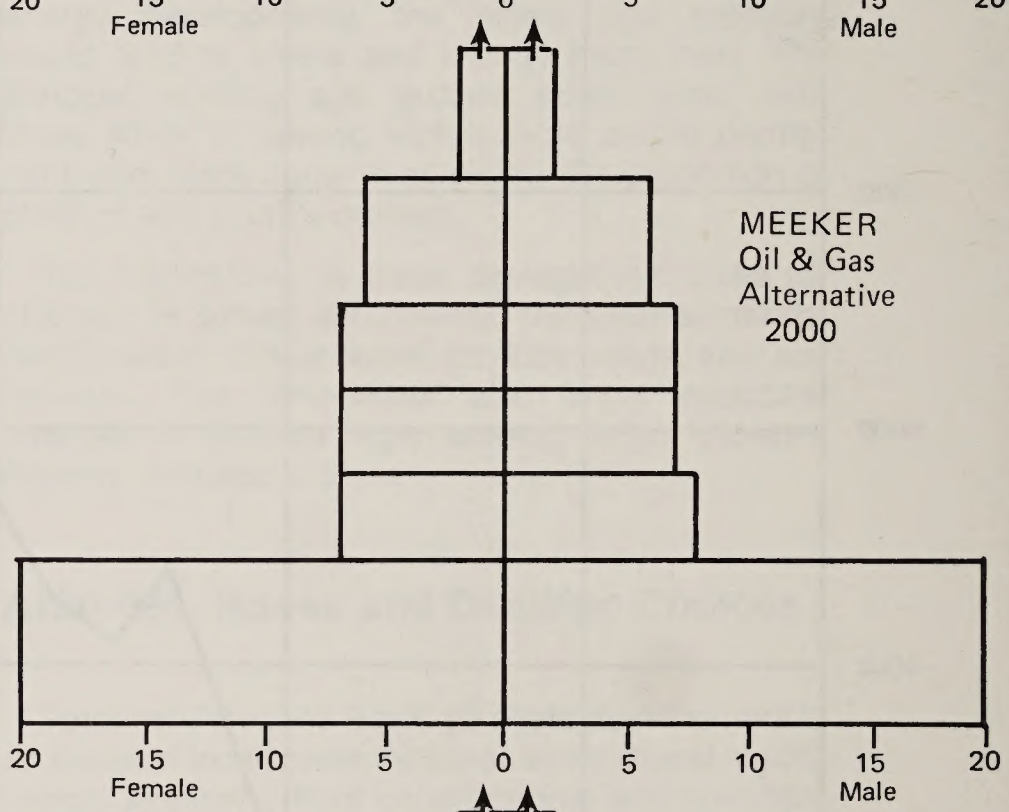


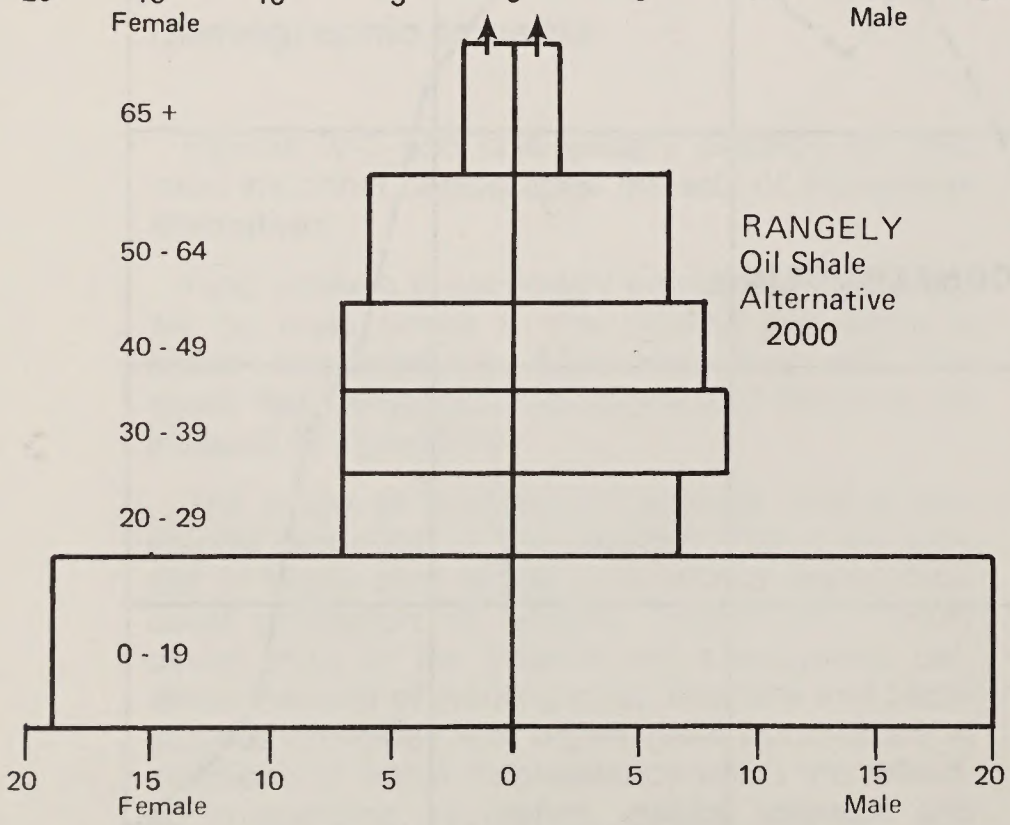
Figure IV-3. Piceance Basin RMP Oil Shale Alternative, Total Direct Employment, All Towns











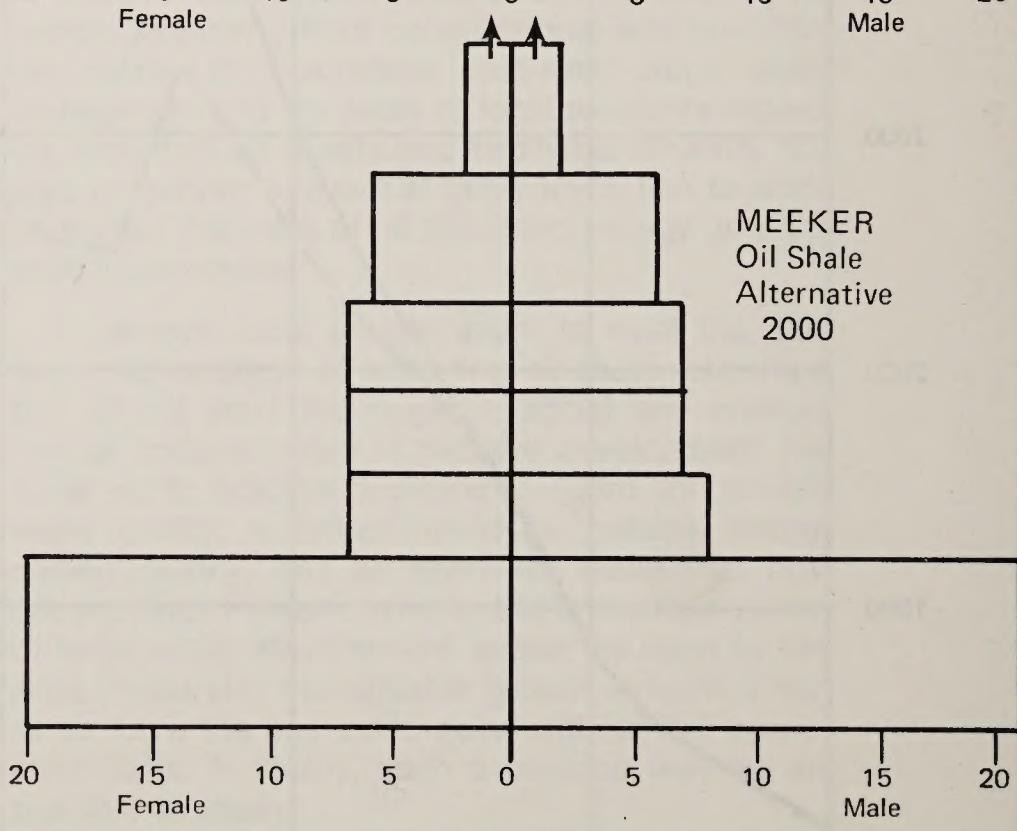


Figure IV-4. Comparative Population Pyramids showing Changes in Age-Sex Ratio from 1980-2000 for Two Alternatives in Rangely, Meeker, and Rifle

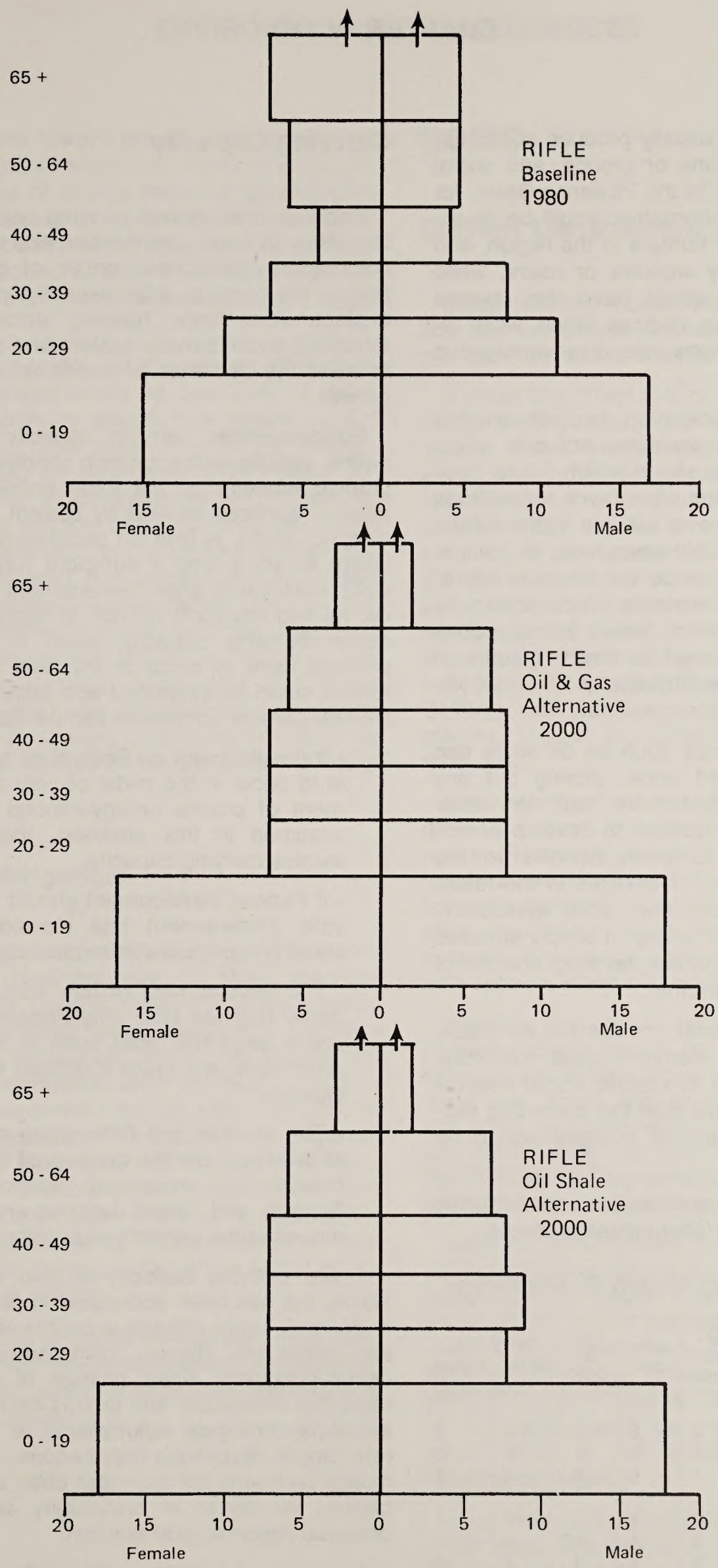


Figure IV-4. (continued)

First, any decision will usually produce social advantages for some persons or groups, and social disadvantages for others. In the Piceance Basin, for instance, the Oil Shale Alternative would be disadvantageous for big game hunters in the region, and advantageous for energy workers or users, while the Wildlife Alternative would have the reverse effect. Decisions are value choices which, while favoring some interest groups, are disadvantageous to others.

A second social consideration involves another moral choice. Land use decisions not only affect the present but also help shape which future decisions are possible and thus often favor either those presently living or those who will live in the future. (Enhancement of renewable resources, of course, favors both.) Objectively, since the future is unpredictable, a decision that restricts future options is less desirable than one which leaves future options open. This notion of the need for flexible futures, in fact, underlies the whole philosophy of conservation, protection of endangered species, etc.

Non-renewable resources such as oil shale can only be mined and used once, closing out any future benefits they might have had for either income or fuel use. The decision to develop or not, therefore, is a choice between benefits in the present (futures foregone) or benefits in the future (presents foregone). From the social standpoint, neither decision is *right* or *wrong*. It simply stresses one set of values over another, favoring one set of persons or groups over another.

These two types of moral choices will be made, knowingly or not. These elements must, therefore, be considered in addition to specific social impacts on communities as described in the preceding sections, if the most responsible choices are to be made.

The following table summarizes the relative social impacts of the four alternatives analyzed.

Relative Degree of Impact Severity By Alternative [1]

Social Element	Current Mgmt.	Wildlife	Oil & Gas	Oil Shale	Preferred
Recreation	2	0	3	4	3
Social Control & Services	1	0	3	5	2
Social Power	1	0	2	4	2
Attitudes					
National	2	1	3	4	2
Local	2	1	3	5	3
Norms & Values	2	1	3	4	2

[1] 0-5; lowest to highest relative severity.

Carrying Capacity

Social and economic carrying capacity refers to the ability of local communities and counties to accommodate the consequences of growth. In particular, the concept addresses the capacity of the in-place labor force, housing stock, public infrastructure, social service system and social structure to meet the demands of economic and population growth.

Socioeconomic carrying capacity is difficult to define, varying with economic conditions, the demographic makeup of the local population and the level of services desired by current residents. It is also not static. A limit on population growth would cease to be a limit if sufficient funding and time were available to allow development of new capacity. All this makes it difficult to estimate socioeconomic carrying capacity, even if the proposed projects were to occur in the near future and the effects could be estimated with accuracy. However, several general comments can be made.

- If development on Federal oil shale resources is to occur in the midst of very active development of private energy-mineral resources (as assumed in this analysis), there will be no excess carrying capacity.

- If Federal development should occur after private development has slowed down, there could be considerable excess capacity.

- The development of new socioeconomic capacity requires time. Any Federal development that is large and rapid, such as in the Oil Shale Alternative, will make it difficult to provide new capacity.

- The Meeker and Rifle areas and associated jurisdictions are the ones most likely to require creation of expanded economic capacity. Rangely and Grand Junction are also likely to require some capacity expansion.

Social carrying capacity is also difficult to describe, but has been addressed in previous studies. In general, social change is continual and normal in any social unit (family, town, country). Problems occur principally when change is so sudden or rapid that individuals and groups cannot accomplish social-psychological adjustments at a comfortable rate. Social disruptions may become visible as community problems but are most often experienced by citizens as losses in community satisfaction and personal psychological comfort.

A number of factors affect the intensity and depth of change (e.g., degree of cultural differences between host populations and in-migrants,

and local attitudes toward growth). The best available single summary measure of negative social impacts in the case of energy resource development in northwest Colorado is annual growth rate. Most authorities, as already noted, place the critical rate beyond which social change is disruptive at between 5 and 15 percent, depending upon these other factors.

Prior to leasing under all alternatives, potentially affected communities would be examined to determine their capability to absorb new people, and if projected growth rates were excessively destructive, leasing could be postponed until a more appropriate time. For a postponement to be made for this reason, local officials of the communities would be consulted, obviously, but in general a projected annual growth rate of five percent should involve caution; if a projected rate is higher than 10 percent, probable postponement or other staggered development procedures would be in order. Of course, to some extent, companies and towns could influence employee distributions by agreeing upon a variety of housing arrangements (such as camps for single workers or the placement of trailer parks).

Committed Mitigation

In an effort to help predict and mitigate socioeconomic impacts resulting from oil shale development, BLM shall consult state and local governments prior to oil shale lease issuance. A condition of the oil shale lease shall be that the lessee and the affected governments shall develop a mutually agreeable socioeconomic impact mitigation plan at the time of submission of the Detailed Development Plan. This lease stipulation shall be similar to Section 15 of the Environmental Stipulations of the Prototype Oil Shale Lease included in Appendix A in the *Final Supplemental Environmental Impact Statement on the Prototype Oil Shale Leasing Program* (USDI, BLM 1983c).

Additional social and economic impact mitigation measures that are recommended for implementation are identified under Uncommitted Mitigation at the end of this chapter.

NOISE

Current Management Alternative

Most existing noise levels are from natural sources, occasional traffic, and scattered oil and gas activities. Current levels are not significant.

If Tract C-a, Tract C-b or any other currently permitted mining operations were to become operational, noise levels would increase in specific areas near projects and along affected highways. Noise levels at tract boundaries would average 60 decibels (dB). Sound levels along affected highways could be expected to increase an average of 2.0 dB which would be noticeable, but not significant. Increased noise along highways would be mainly due to heavy truck traffic. Highest noise levels would occur during construction phases, and would decrease slightly during operational phases. Blasting during mining activities would have the greatest impact on receptors in the vicinity of a mine tract.

The effects of increased noise would have the greatest impact on sensitive receptors in affected areas. Receptors would include residences and ranches, wildlife, livestock and recreational users (primarily hunters) of remote areas. Impacts associated with noise could include hearing loss, increased annoyance, and behavioral interference with speech, sleep and work.

Hunters and other recreational users of the Piceance Basin would be annoyed by increased noise levels. Wildlife could be dislocated from traditional use areas. Personnel on construction sites and plant operators would be subjected to hazardous noise levels, but would be protected form hearing damage by Occupational Safety and Health Act regulations and mitigating measures.

Distance, atmospheric conditions and topography act to decrease sound energy emanating from a point source at ground level (US Dept. of Air Force, et al 1976). Noise produced by mining activities (except for blasting) would approach the level of existing background noise at a radius beyond four miles of the point source. Residents within 500 feet of highways would be most impacted by truck noise. Most of the affected area is rural and sparsely populated.

The impacts from increased noise levels from oil shale operations should be considered long-term as development would last over fifty years. There exists a potential cumulative effect if several mining operations were to be producing concurrently.

Wildlife Alternative

Impacts from noise are expected to be less than that described in any of the other alternatives. The lower noise level is expected due to the restrictions placed on surface disturbing mineral development.

Oil and Gas Alternative

Impacts from noise would be the same as those described in the Current Management Alternative with the exception of increased noise associated with oil and gas exploration, development and production. Giving priority to a large acreage of lands to encourage development of oil and gas resources would increase the level of exploration for that resource in the basin. As a result, noise levels would be expected to increase (especially if a gas or oil field is discovered) along major highways from drill rig service vehicles. In addition, exploration would increase the short-term occurrence of increased noise levels in remote areas. If production is established in the remote areas, then noise levels would be higher in the long-term than present levels in those remote areas due to well-head maintenance activities.

Oil Shale Alternative

Impacts from increased noise levels would be similar to the Current Management Alternative, but would be more pervasive throughout the Piceance Basin due to the potential of more oil shale projects becoming operational. Noise levels on affected highways would exceed an increase of 3 decibels over existing levels; this increase would be significant. The potential for cumulative noise impacts would be greater.

If a railroad spur were constructed into the Piceance Basin, a new source of noise would impact previously undisturbed areas.

The main source of increased noise levels along highways would be from heavy trucks hauling sodium and/or shale oil products to the railhead at Rifle. The use of pipelines to transport shale oil and a railroad spur in the basin to carry out hard mineral products would reduce noise impacts along highways in the long-term.

Preferred Alternative

Impacts from noise would be similar to those described in the Current Management Alternative.

TRANSPORTATION

Current Management Alternative

The major road segments affected would be Colorado 13/789 from Rio Blanco to the railroad at Rifle and Piceance Creek road. The traffic volume capacity for these road segments would be exceeded resulting in traffic slowdowns. These roads could be heavily impacted by a high volume of heavy truck traffic resulting from construction activities and transport of shale oil and sodium mineral products. Traffic would be highest during construction phases and would be somewhat lower during operational phases. Other highway segments would primarily be impacted by employee and ancillary traffic.

Final completion of the C-a to Rangely road may be postponed under the Current Management Alternative, due to the lack of funding and the current slowdown in the oil shale industry. Voluntary five-year plans for oil and gas lease development are expected to be only minimally effective since experience to date has been marked by lack of participation by lessees. Reclamation of *temporary* oil and gas roads, and pipelines would continue in a haphazard manner due to weak bonding requirements and lack of funding for compliance. Secondary road development could respond to specific needs of various energy projects and could result in a dispersed network of roads.

No impacts are anticipated to rail service under current management. No major pipelines are planned for the Piceance Basin, but a major line such as the planned La Sal project would be implemented. New gathering lines could respond to individual well development and would be dispersed throughout the basin. There would be little incentive to use identified utility corridors.

Wildlife Alternative

The requirement to prepare a five year plan of development upon issuance of new and renewed oil and gas leases would reduce impacts over time as follows: 1) secondary road construction would

be reduced by 27 percent, 2) pipeline construction would be reduced by 35 percent (USDI, BLM February 1982). If the Craig District Transportation Plan were updated in concert with five year plans, unnecessary duplication of BLM, County, and oil and gas roads could be avoided.

By officially designating utility corridors, utility developers would be encouraged to locate within designated corridors. The incentive would be that location of most linear facilities within a designated corridor would not require environmental analysis or an environmental statement. The proponent would benefit by a savings of time normally expended in analysis and permitting, and a savings of funds which would be expended on the preparation of environmental documents. Overall, this alternative would increase transportation planning and would reduce unnecessary impacts.

Oil and Gas Alternative

The same impacts would occur as in the Current Management Alternative, except that if a more favorable market for oil and gas were to develop, impacts would increase proportionally with accelerated development. Transportation networks of secondary roads would be extensively dispersed throughout the Piceance Basin. More land would be "temporarily" taken out of production (*temporarily* is a relative term due to the life span of an oil or gas well which could range from six months to 30 years). Access to public lands would be maintained or improved with additional road construction and a more extensive network of roads.

Oil Shale Alternative

With increased energy development, transportation demand would increase for new roads, road improvements, utilities and possibly rail service into the Piceance Basin. Impacts to life and property would increase with additional transportation development.

Predicted traffic accidents would increase on all road segments, but most significantly on the highway between Rio Blanco and Rifle. Potential damage to the most heavily used road segments could be significant. Surface oil shale operations would contribute more damage than the in-situ type of mining operations.

The impacts listed above would primarily result from the use of heavy trucks to transport mined products to a railhead. These impacts could be substantially reduced if alternative means of transport were used. Some of these alternatives include pipelines, slurry pipelines, a rail spur into the planning area, conveyor systems and private haul roads. Pipeline transport for shale oil and a railroad for solid minerals would probably be the most practical and least impacting methods of transport.

Existing State and County roads would have to be upgraded in order to accommodate increased use and heavier traffic. New roads and road improvements would increase the demand for sand and gravel resources. State and County governments should be reimbursed for additional expenses incurred for road improvements and maintenance. A rate of 1.4 cents per ton-mile should be expended over and above taxes and license fees currently being paid.

It is anticipated that the Denver and Rio Grande Western railroad would have the capacity to absorb increased product transport (USDI, BLM 1983d). Additional costs to rail lines would be incurred for future capital improvements and on-going maintenance to rail lines needs.

Preferred Alternative

Vehicle accidents and the percent of highway capacity utilized would exceed that described in the Current Management Alternative but would be less than described in the Oil Shale Alternative. The level of impacts would primarily depend on the level of mining activity taking place. Cumulative impacts could be anticipated, especially if private mining projects occur along with those occurring on public lands.

Development of transportation systems, as described in the Oil and Gas Alternative and the Oil Shale Alternative, would be encouraged. Transportation systems would be concentrated in utility corridors as described in the Preferred Alternative. Based on past experience, it is anticipated that voluntary submissions of five year plans by oil and gas lessees for roads and pipelines would not be successful in increasing transportation planning and reducing cumulative impacts to any significant degree by oil and gas lessees.

NET ENERGY ANALYSIS

Current Management Alternative

Currently, most energy consumption occurs in oil and gas exploration and development by use of fossil fuels. Energy expenditures are not significant. If Tracts C-a, C-b and C-11 or C-18 become operational, energy expenditures and production would increase significantly. Oil shale development is very energy intensive; the major external energy source required to produce shale oil would probably be electricity. Electrical generation requirements per operation would range from 21.9 to 230.8 megawatts of generating capacity, depending on production scenario. Modified in-situ methods consume less direct electrical energy than direct mining/surface retorting or true in-situ processes.

If current electrical production capacity in the region proves insufficient to meet electrical demand, electricity would have to be imported, or another generating station could be built to meet the specific demands of shale oil production. The results of any option would be an increase in the consumption of coal which is used to fire generating plants. Coal is a non-critical fossil fuel and is abundant in the region. An irretrievable commitment of secondary energy resources such as coal, oil and gas would be expended in the construction and operation of oil shale resource production facilities.

Onsite electrical generation could reduce, meet or exceed the electrical demand requirements for the production of shale oil. Onsite energy generation could possibly be accomplished by use of low BTU off-gases produced in the retorting process. Technology for this alternate form of onsite energy generation is presently unproven.

The net energy analysis presented in the *Final Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program* (USDI, BLM 1983c) indicated that net energy production does not differ so much from tract to tract as it does by type of development and production rates. Table IV-8 presents a typical net energy analysis. A typical oil shale tract could produce 0.5 percent to 2.0 percent of annual oil import needs at 1981 consumption rates. The net energy ratios (output:input) shown in Table IV-8 range from 2.5-4.6:1. Because shale oil production is so energy intensive, oil shale has a less favorable net energy balance than coal, natural gas or most alternate sources of energy. Table IV-9 presents a comparison of the net energy balance for various sources of energy production (Gilliland et al 1981).

TABLE IV-8

SUMMARY OF DAILY ENERGY REQUIREMENTS

Energy Type	Low Production Rate (25,000 bbls/day)			High Production Rate (50,000 bbls/day)		
	Direct Mining and Surface Retort	Mine Assisted In-Situ	True In-Situ	Direct Mining and Surface Retort	Mine Assisted In-Situ	True In-Situ
Direct Electrical	642,145 kwh	419,250	2,216,350 kwh	1,332,800 kwh	879,360 kwh	4,431,070
Direct Petroleum Direct	17,760 gal	46,000 gal	33,271 gal	95,107 gal	32,407 gal	66,542
Natural Gas Total	900,000 scf	900,000 scf	900,000 scf	1,800,000 scf	1,800,000 scf	1,800,000 scf
Energy Produced* Total	$1.45X10^{11}$	$1.45X10^{11}$	$1.45X10^{11}$			
			$2.9X10^{11}$	$2.9X10^{11}$	$2.9X10^{11}$	
Energy Consumed* Energy	$56.79X10^{9}$	$33.79X10^{9}$	$39.72X10^{9}$			
			$75.2X10^{9}$	$63.11X10^{9}$	$75.11X10^{9}$	
Ratio of Energy Out:Energy In	2.55:1	3.65:1	3.65:1	3.86:1	4.60:1	3.86:1

* In BTU's
kwh = kilowatt hour
gal = gallons
scf = standard cubic foot

TABLE IV-9

NET ENERGY BALANCE FOR ENERGY RESOURCES

Energy Source	Ratio of Energy Out:Energy In
Natural Gas *	43-56:1
Domestic Crude *	20:1

TABLE IV-9—Continued

NET ENERGY BALANCE FOR ENERGY RESOURCES

Energy Source	Ratio of Energy Out:Energy In
Synthetic Oil and Gas from Coal *	16-20:1
Vapor Geothermal	10-13:1

TABLE IV-9—Continued

NET ENERGY BALANCE FOR ENERGY RESOURCES

Energy Source	Ratio of Energy Out:Energy In
Small Scale Hydroelectric	
Coal	
Lignite	
Nuclear	4-5:1
Ocean Thermal	
Solar Power Tower	
Liquid Geothermal	
Synthetic Oil from Oil Shale *	3-9:1
Solar Power Satelite	2-3:1
Hot, Dry-Rock Geothermal	

Source: M. W. Gilliland et al 1981.
* Expresses energy output as the fossil fuel equivalent of electricity
Note: All ratios are approximations and are rounded to the next highest whole number.

Wildlife Alternative

No significant changes in the net energy balance would be expected from that described in the Current Management Alternative.

Oil and Gas Alternative

No significant changes in the net energy balance would be expected from that described in the Current Management Alternative. However, exception to this would be that increased oil and gas development would increase energy demand and production in relation to that resource's energy balance.

Oil Shale Alternative

The net energy balance for shale oil production would be the same as presented in the Current Management Alternative. With the onset of multiple oil shale operations in the Piceance Basin, the demand for imported electricity would increase proportionally. Electrical demand would have to be assessed; surplus or deficit electrical supply demanded in the region at a particular point in time would determine the potential need for a new coal fired generating plant. Also new technologies, especially the use of onsite electrical generation using low BTU off-gases, would have to be considered to determine the total future demand for electrical supply.

Preferred Alternative

Net energy balance would be similar to that described in the Current Management Alternative, except for additional energy consumption and generation due to slightly increased oil shale activity.

SUMMARY OF IMPACTS

Table IV-10 summarizes the significant impacts identified in this chapter in a comparative format for the five alternatives considered. This is intended only to give the reader an easy way of comparing the major environmental consequences of the different alternatives and is not intended to be comprehensive.

In addition to the comparison of impacts by alternative included in the table, a summary of impacts by resource affected is described below. Proposed mitigation measures which address these impacts are also included below in the Uncommitted Mitigation section.

TABLE IV-10

SUMMARY OF ANTICIPATED IMPACTS BY ALTERNATIVE

RESOURCE ELEMENT	ALTERNATIVES				
	CURRENT MANAGEMENT	WILDLIFE	OIL AND GAS	OIL SHALE	PREFERRED
Air Quality	Increases in ambient polluted levels. All levels probably below long-term Class II and Class I allowables, and well below NAAQS, (except as noted for particulates and ozone). Short-term Class I increments could be equalled or exceeded. Possible short-term concentrations of dust, ozone and CO near NAAQS in urban areas. Probable significant effect on increased visible plume (discoloration). Probably general decrease effect in visual range (regional haze), and general increase of acid deposition.	Increases in ambient pollutant levels. Probably well below long-term Class II and Class I allowables, as well as NAAQs, (except as noted for particulates and ozone). Short-term Class II and Class I increments could be equalled. Possible short-term concentrations of dust and ozone and CO near NAAQS in urban areas. Probable significant effect on increased visible plumes (discoloration). Probably general decrease effect in visual range (regional haze), and general increase of acid deposition.	Equivalent to the Current Management Alternative.	Increases in ambient pollutant levels. Probably up to maximum allowable for long-term Class II and Class I increments. Probable exceedence of short-term Class II and Class I increments. Possible short-term concentrations near maximum allowable for Class II areas, but all concentrations well below NAAQS (except as noted for particulates and ozone). Possible short-term concentrations of dust, ozone and CO near NAAQS in urban areas. Probable significant impact on visual range (regional haze), increased visible plumes (discoloration), and general increase of acid deposition.	Equivalent to the Current Management Alternative.
Minerals					
Oil Shale	Possible loss of oil shale resources from early development of oil shale. Higher recovery rates anticipated for future development as technology improves. Possible loss of oil shale resources due to sodium-only development on existing leases and PRLAs. Loss of unrecoverable oil shale potentially irretrievable. Conflicts with oil/gas and other minerals would generally be resolvable; impact would be insignificant.	Longest delay in oil shale development would result in largest short-term loss of oil shale. Long-term recovery increased if improved technology developed. Fewer leases and longer wait between lease offerings when oil shale market develops.	Possible short-term loss of oil shale production form multimineral zone which contains richest and thickest oil shale deposits. Long-term recovery would be greater. Recovery of reserves would be delayed until technology improves recovery rates. Possible loss of 70 to 80 percent of the oil shale resources due to underground mining from oil shale lands outside of multimineral and open pit zone in short-term. Could also result in significant loss of oil shale production due to oil/gas priority. Future sodium-only leases could result in more difficult oil shale recovery.	Fastest rate of oil shale development will result in largest short-term recovery, largest unrecoverable reserves may be irretrievably lost due to low recovery rates. Many deposits that could be recovered in future with improved technology may be irretrievably lost if mined now.	Similar to Oil and Gas Alternative, except no additional losses due to new sodium-only leases.
Sodium	Possible loss of production of significant quantities of nahcolite and dawsonite resources if no new leases are issued and no production takes place from existing leases are issued and sodium market develops, an increase in production could be expected.	Sodium recovered from new leases only if oil shale market develops. Sodium deposits may not be developed independently of oil shale.	Same as Current Management.	Sodium recovery dependent on oil shale market since only concurrent development allowed. Sodium deposits may not be developed independently of oil shale.	Same as Current Management Alternative.

TABLE IV-10—Continued

SUMMARY OF ANTICIPATED IMPACTS BY ALTERNATIVE

RESOURCE ELEMENT	ALTERNATIVES				
	CURRENT MANAGEMENT	WILDLIFE	OIL AND GAS	OIL SHALE	PREFERRED
Coal	Coal development unlikely in near future, primary conflicts with oil and gas. Little resource recovery anticipated.	Coal development even less likely than Current Management.	Same as Current Management.	Same as Current Management.	Same as Current Management.
Oil & Gas	Conflicts with other minerals could be resolved resulting in insignificant loss of O/G production. Loss of O/G resources due to unrecoverability with present production techniques.	Additional stips could increase loss of O/G production. More leases would be issued with a no surface occupancy stipulation to protect other important surface resources.	Increase in O/G production as market and economy demands. Increase in O/G resources left in ground as unrecoverable due to present production techniques. More oil and gas leases would be issued with priority over oil shale and could result in a restriction of oil shale development.	Possible significant loss of oil/gas production due to conflicts with oil shale development.	Similar to Current Management Alternative.
Locatable Minerals	No significant impacts; almost entire planning area is within oil shale withdrawal closed to locatable mineral entry.	Same as Current Management Alternative.	Same as Current Management Alternative.	Same as Current Management Alternative.	Same as Current Management Alternative.
Saleable Minerals	No significant impact.	No significant impact.	No significant impact. Could increase number of temporary impacts. Permitting of sand and gravel may increase due to increased number of roads associated with oil and gas development.	Same as Oil & Gas Alternative.	No significant impacts.
Floodplains and Alluvial Valleys	Floodplains and alluvial valleys may be impacted in both quantity and quality by direct disruption from oil shale open pit and coal surface mining. Also they could similarly be affected by underground mining methods by formation fractures which provide intercommunication between the two. Secondary impacts could impact hay production and springs necessary for livestock and wildlife use.	Floodplains and alluvial valleys may be primarily affected by underground mining via fracture intercommunication to the surface. Secondary impacts to hay production and springs could also occur.	Same as Current Management Alternative.	Same as Current Management Alternative.	Same as Current Management Alternative.

Agricultural Lands	Implementation of this alternative would maintain the present productivity of agricultural lands. The quantity of surface disturbances occurring under this alternative would be greater than the Wildlife Alternative, but less than the Oil and Gas and Oil Shale Alternatives.	Implementation would maximize agricultural land productivity in the Piceance Basin by reducing the need for additional access roads. Also, water quality for irrigation would be improved due to the more stringent mitigation requirements on surface disturbances.	Primary impacts would consist of road access for oil and gas exploration and development and corridors which would be dispersed throughout the planning area. This would result in decreased acreage under meadow hay production and may lower the carrying capacities of ranches dependent on the supplemental forage during the winter months. Irrigation water quality may also be lowered due to the increased erosion and sediment transport which would lower productivity on agricultural lands.	The quantity of surface disturbing activities would be greatest under this alternative which would have the greatest impacts on the productivity of agricultural lands. More acreage would be lost from agricultural production than under any other alternative. Irrigation water quality would also be the most severely impacted, in turn possibly lowering the ranchers carrying capacities due to a shortage of supplemental forage. Corridor development and urban expansion would also impact agricultural lands. Mesa County orchard lands could also be potentially impacted due to community expansion.	Environmental consequences described in the Current Management Alternative would also occur here. Agricultural land impacts form energy development as described in the Oil and Gas and Oil Shale Alternatives would also occur, but to a lesser degree.
Soils	Implementation of Current Management would continue to improve the quality of the soil resource with enforcement of the stipulations in the Oil and Gas Umbrella EA. the quantity of surface disturbance occurring under this alternative would be greater than the Wildlife Alternative, but less than in the Oil and Gas and Oil Shale Alternatives.	Implementation would maximize productivity of the soil resource while minimizing disturbances on productive or fragile soils. More stringent mitigation requirements on surface disturbances would lessen the impact intensity to the soil resource and therefore decrease the soil loss and sediment transport to the White River.	Primary impacts would consist of surface disturbances form oil and gas exploration and development, dispersed throughout the planning area. The increase in road construction would increase the soil loss ad sediment transport to the White River. with additional new roads the potential for landslides is tremendously increased.	The quantity of surface disturbing activities would be greatest under this alternative. Long-term impacts to the soil resource would occur by increased erosion from wind and water from areas stripped of vegetation for mineral exploration, development and construction of facilities. Soil loss and sediment yield would significantly increase. this impact is not quantitifiable at present due to the unknown rate of development.	Increased implementation and enforcement of reclamation stipulations would improve soil resource conditions. The quantity of impacts from oil and gas development would be similar to those presently occurring in the planning area. Long-term impacts to the soil resource would occur in oil shale development areas as described in the Oil Shale Alternative.
Hydrology	Current management practices would allow for continued levels of existing water quality and quantities. Major impacts to water quality would be from grazing, mineral development and the limited amount of road construction from forestry and oil and gas program.	The Wildlife Alternative could allow for the lesser impacts and the more intense management practices to improve existing conditions and limit degradation of watersheds.	The proposed development of oil and gas could impact water quality. The potential for increased communication and contamination between aquifers exists with increased development. Sediment loads to receiving waters could increase form any surface disturbing activities related to development. Potential spills of fuels or chemicals could pollute surface waters. Oil shale open pit mining would also cause destruction f the aquifer system in various parts of the basin and could result in the loss of spring and surface flow in the region surrounding the open pit zone. Water augmentation plans would have to be filed with the state for oil shale development.	Same as Oil and Gas, although impacts would be more intense with a greater magnitude of impacts on aquifer systems due to the greater level of oil shale development.	Similar to Oil and Gas Alternative.

TABLE IV-10—Continued

SUMMARY OF ANTICIPATED IMPACTS BY ALTERNATIVE

RESOURCE ELEMENT	ALTERNATIVES				
	CURRENT MANAGEMENT	WILDLIFE	OIL AND GAS	OIL SHALE	PREFERRED
Vegetation	Continuation of implementation of 1980 Grazing Management EIS and 1980 MFP would increase the frequency of desirable herbaceous and browse species in the vegetation composition. Cover and production of desirable species would increase in all vegetation types. Surface disturbance impacts due to non-renewable resource development would be mitigated by prompt reclamation and revegetation with adapted species.	Impacts on vegetation resulting for selection of this alternative will be very similar to those described for continuation of Current Management. The creation of "Special Management Areas" could have a negative impact on "sensitive" plant species, as these may not be competitive in the absence of grazing by domestic herbivores. Conserverly, exclusion of all surface disturbance could positively benefit these species.	Primary impact would be removal of vegetation due to surface disturbance from oil and gas exploration and production. It would be reasonable to expect (given the right economic climate) that roughly 1000-1200 acres of vegetation would be destroyed on an annual basis if this alternative is selected. This activity would be dispersed, but would occur primarily west of Piceance Creek.	Full scale oil shale development, including surface mining ad product transport could result in total removal of 25,000 acres of vegetation over the next 20 years. In the case of waste disposal, it may be impossible to replace vegetation cover due to problems with successful revegetation on spent shale. Most plant communities within the Piceance Basin would be significantly and negatively impacted and probably would be irretrievably altered.	Implementation of the 1980 Grazing Management EIS would increase the frequency of desirable herbaceous and browse species in the vegetation composition. Cover and production of desirable species would increase in tall vegetation types. Impacts from energy development would be similar to those described under the Oil and Gas and Oil Shale Alternatives although quantitatively less.
	Meets all forest management objectives including volumes sold, public demand and perpetuity of forest lands.	Same as Current Management, with the exception of recommended ACECs, RNAs and ONAs which would remove from harvest a very significant portion (75%) of commercial Douglas fir. Anticipate higher significance associated with pinyon-juniper firewood sales.	Volumes would probably exceed public demand for sawtimber products. Sales would be prepared and offered, but probably not all sold. Would result in conflict with Forest Management Plan. Increase in firewood products would be due to increase in land clearing from oil and gas activity. No control on eventual use of this timber. Public demand would not necessarily be met. Fewer acres available for intensive forest management.	Sawtimber and firewood volumes would not meet public demand for forest products.	Similar to those described for Current Management with the exception of additional acreas of pinyon-juniper lands lost to production lost from shale activities.
	Some acres would continue to be taken out of and lost to production due to energy related activities.	Anticipate decrease in number of acres lost to forest production from energy activity.	Anticipate significant increase in number of acres lost to forest production.	Range improvements though firewood sales would not occur. Long-term loss of pinyon-juniper woodlands in oil shale development areas.	Impacts would be similar to those in the Current Management Alternative.
	The quantity and quality of livestock forage production and economic returns to livestock operations would increase.	Impacts would be beneficial since oil shale and oil and gas surface disturbances would be severely restricted. Approximately600 AUMs would be lost due to exclusion of livestock from Special Management Areas.	A significant level of livestock forage would be lost due to development of oil and gas facilities, roads and well pads over the next 20 years.	Impacts of forage loss would be similar to the Oil and Gas Alternative, except at a greater magnitude. Forage loss would occur primarily on six allotments.	Impacts would be similar to those in the Current Management Alternative.
	The quantity of surface disturbances occurring under this alternative would be greater than the Wildlife Alternative, but less than in the Oil and Gas and Oil Shale Alternatives. Known populations of rare or sensitive lands could be lost by surface disturbing activities if alternative location for projects could not be found which may prompt the listing of some plants as threatened or endangered.	Implementation would protect all known populations or rare and sensitive plants and remnant vegetation associations by excluding surface disturbing activities. This alternative would also protect areas of potential habitat to allow for the spread of these rare and sensitive plants to keep them from becoming threatened or endangered.	Primary impacts would result form surface disturbing activities from oil and gas exploration and development which may cause the loss of rare and sensitive plant populations. Even though surveys for rare and sensitive plants would re required, if alternative locations could not be used the populations could be lost, resulting in the possible listing of these plants as threatened or endangered.	The quantity of surface disturbing activities would be the greatest under this alternative which would have the greatest impacts on rare and sensitive plants. This would accelerate the rate at which these plants would be added to the threatened or endangered species list.	Impacts to rare and sensitive plants would be similar to those described in the Current Management Alternative. However, the potential for impact would be greater due to an increase in surface disturbance under this alternative.

Wildlife	Implementation of the Piceance Basin Habitat Management Plan would continue to improve habitat conditions with emphasis towards recreational species, raptors and T&E species. Adverse surface disturbance impacts from oil shale, oil and gas activities would result forage available to wildlife. the quantity of surface disturbance occurring under this alternatives would be greater than in the Wildlife Alternative, but less than in the Oil and Gas and Oil Shale Alternatives.	Impacts would be similar to the Current Management Alternative. Accelerated implementation of the Habitat Management Plan would achieve desired habitat conditions sooner. More stringent mitigation requirements on surface disturbing activities would lessen impact intensity to the wildlife resource. Quantity of such impacts would be less than under the other three alternatives. Requiring corridor use would reduce quantity and consolidate location of surface disturbances.	Primary impacts would consist of surface and human disturbance form oil and gas exploration and development. Impacts would occur throughout the planning area. the dispersed location of development could significantly impact habitat conditions and wildlife use over the majority of the planning area. This impact would be most critical to wintering mule deer.	The quantity and duration of surface disturbance would be greatest under this alternative. Long-term impacts to the wildlife resource would occur. Replacement of preferred herbaceous and browse species for wildlife may be difficult. Water quality and quantity impacts may be significant. A reduction in wildlife populations below current BLM-Colorado Division of Wildlife objectives would not meet the resource demand.	Environmental consequences described in the Current Management Alternative would occur here also. In comparison and quantity of surface disturbing impacts would be greater than those of the Current Management Alternative, but moderately less than in the Oil and Gas or Oil Shale Alternatives.
Wild Horses	Continued implementation of 1982 Piceance Herd Management Area Plan would result in improvement in forage quality and availability for wild horses. Long-term vegetation allocations will provide for an optimum herd size of 100 horses. Horse bands would be mananged to minimize inbreeding within bands. Loss of forage would occur form surface disturbing activities due to energy development activities.	Impacts essentially the same for this alternative as those described for Current Management.	As noted in 1981 WRRA Oil and Gas Umbrella EA negative impacts on wild horses would include reduction in the amount of their habitat, increased human disturbance and modification of the patterns of movement and concentration. A large percentage of accelerated oil and gas activity is expected to occur within the Piceance Herd Management Area. Direct forage loss would occur.	Impacts on wild horses associated with full scale oil shale development would be similar to those described for oil and gas; however these will be concentrated and in the case of Tract C-a will probably eliminate horses form their designated ranges in pasture C, Square S Allotment, Boxelder and 84 Mesa. Any full scale development of oil shale in this area will have to provide for maintenance of the herd on their designated range. Direct forage loss would occur.	Impacts form this alternative would be similar to those described under the Current Management and Oil Shale Alternatives. the rate of impacts occurring from oil shale development would be less than those described under the Oil Shale Alternative.
Cultural Resources	A support activity for other programs which propose surface disturbing activities. Potentially adverse impacts would be mitigated using existing regulations and Bureau policy and procedures.	Reduced surface disturbance and protection of fragile soils would beneficially impact cultural resources.	Same as Current Management.	Surface disturbance would be greater than under any other alternative. Therefore, impacts to cultural sites would be greatest under this alternative.	Impacts would be similar to those described under Current Management Alternative.
Paleontological Resources	Paleontological resources would be impacted if the existing sodium leases and PRLAs are developed. If new oil shale and coal leases are issued, development on these leases could cause additional impact to paleo resources.	Least impactive of all other alternatives to Paleontological Resources. Impacts caused by oil shale, coal and sodium underground mining could go unnoticed.	Paleontological resources would be impacted to a lesser degree than the Current Management Alternative. Impacts caused by intensive oil and gas development if it occurred could cause impacts regionally to paleo resources and could go unnoticed due to the extensive amount of road construction. Impacts caused by coal surface mining and oil shale open pit mining could result in a loss of paleo resources.	Same impacts as that listed for the Oil and Gas Alternative. However a lower level of oil and gas activity would result in smaller regional paleo impacts.	Similar impacts as those listed for the Oil and Gas Alternative.

TABLE IV-10—Continued

SUMMARY OF ANTICIPATED IMPACTS BY ALTERNATIVE

RESOURCE ELEMENT	ALTERNATIVES				
	CURRENT MANAGEMENT	WILDLIFE	OIL AND GAS	OIL SHALE	PREFERRED
Recreation	Continuation of adverse hunting conditions where quality of hunt, convenience, health and safety area tat a less than desirable level. Access to public lands is limited on 11,000 acres due to oil shale projects. Roaded natural and modern urban areas would continue to expand, conversely, semi-primitive motorized areas reduced equally.	Overall stabilization of Recreation Opportunity Spectrum classes except in oil and gas and oil shale development areas and where ORV restrictions take place. Benefits to recreation program in improved access and visitor services. 5,000 acres seasonal ORV restriction in Non-motorized Hunting Area. 162,500 acres seasonal ORV restriction Dec.-April for wildlife. 3,500 acres permanent ORV closure, 20,500 acres restricted for ACECs, 11,000 acres of access lot to oil sale projects, roads closed during saturation periods.	Same as Current Management Alternative except 16,000 acres of access closed by oil shale activity. 5,000 acres seasonally closed to ORV use in Non-motorized Hunting Area. 5,500 acres of permanent ORV restrictions form 3 ACECs. Roads closed during saturation periods. Diversification of recreational opportunity by ORV closures.	Reduction of access in areas of oil shale development due to safety hazards and security (Approx. 29,000 acres). Increased recreational use, especially hunting and ORV pressure. Safety hazard of hunting increased relative to use. Modern urban areas expand some 5 times over current management. 5,000 acres seasonally closed to motorized vehicles in Non-motorized Hunting Area. Manpower and funding needs increased for information and enforcement (visitor services), development.	Would be similar to those described under the Wildlife Alternative, except oil shale development increases modern urban class about 2X, and ACEC ORV closure is only 160 acres.
Visual Resources	Continued degradation of scenic resources in-areas of oil and gas and oil shale development (roads, pipelines, plants, etc.). Maintenance of VRM classes in other areas.	Same as Current Management Alternative, although less acreage would be impacted.	Same as Current Management Alternative, except area impacted vastly increased (less than oil shale however). Oil pad areas converted to VRM Class V until rehabilitated.	Same as Oil and Gas Alternative, except additional mining and disposal areas created where VRM class would be degraded to Class V until rehabilitated.	Would be similar to those described under Current Management Alternative.
Social and Economic	The development of each oil shale tract could increase area population by up to 10,000 people. While dependence on existing infrastructure would be significant, impacts would not be as severe as under the Oil and Gas and Oil Shale Alternatives. More than half of the impact will be felt in the Rifle-Battlement Mesa area of Garfield County, one-third in the Meeker area, with residual impacts in the Rangely and Grand Junction areas. Beneficial impacts will result from tax revenues, property values, job opportunities and increased wage levels.	Possible development of one oil shale tract would create the same impacts which are discussed under Current Management Alternative though to a lesser extent.	Impacts to existing infrastructures and housing would be severe. The magnitude of impacts would depend on the amount and schedule of other energy development in northwest Colorado.	This alternative would have the most severe social and economic impacts. The existing carrying capacity of Rio Blanco and Garfield counties would be drastically exceeded. Previous boom-bust cycles would have made the affect communities increasingly resistant to development at this level.	Impacts would be similar to those described under Current Management Alternative.

Noise	Most existing noise levels areas from natural sources, occasional traffic and scattered oil and gas activities. Current levels are not significant.	Same as Current Management.	Same as Current Management.	Significant noise increases would occur during construction phases of oil shale activities. Noise levels would drop when construction ends and operational phases begin, but would be higher than under Current Management. Noise would mainly impact local ranchers and hunters. Other would be affected by increased traffic noise. Mitigating techniques would have to be employed on a project specific basis.	Same as Current Management Alternative.
Transportation	Completion of phase II of the C-a to Rangely Road may be delayed. Voluntary 5-year plans for oil and gas lease development not likely to be effective. Reclamation will continue in a haphazard manner due to weak bonding requirements and lack of funding for compliance. A dispersed network of secondary roads would occur.	The requirement to issue new or renewed oil and gas with a 5-year plan of development would reduce impacts over the long run as follows: Road construction by 27% and pipeline construction by 35%. Up-dating the District Transportation Plan in concert with the above could reduce impacts even more. The use of designated corridors would further consolidate transportation and reduce dispersion of impacts. Overall, this alternative would increase transportation planning and would reduce unnecessary impacts.	The same impacts would occur as in Current Management, except that a more favorable market for oil and gas would increase impacts proportionally with development. Access for other users of the public lands would be maintained or improved with additional road construction.	With increased energy development, transportation needs would increase for new roads, road improvements, utilities, and possibly road service. Primary roads would have to be upgraded, (which would increase the demand for sand and gravel resources). The C-a to Rangely Road would probably be completed. Product pipelines would be encouraged to reduce impacts to existing roads form truck haul.	Impacts would be similar to those described under current management with the exception that corridors would be designated thus minimizing unnecessary surface disturbance.

ENVIRONMENTAL CONSEQUENCES

Adverse Environmental Effects which cannot be Avoided

Air Quality

Some pollutants (primarily TSP, carbon monoxide, lead, ozone, NO_x, and SO_2) will enter the atmosphere regardless of the alternative selected. However, compliance with state and Federal laws should keep these impacts to a minimum. Reduced visibility and some acid deposition is likely to occur regardless of the alternative selected.

Minerals

Oil Shale

Low grade oil shale resources may be unavoidably lost due to mixing with overburden material during open pit mining techniques and interburden material for underground mining. Development of sodium resources whether by new or existing leases may unavoidably result in oil shale resources being lost or degraded due to subsidence, exposure, and material handling during sodium mining activities. Designation of 12 potential Special Management Areas may unavoidably preclude or delay production of oil shale minerals in those areas.

Sodium

Development of oil shale resources under the Current Management, Wildlife and Oil Shale Alternatives may unavoidably result in sodium resources being lost or degraded due to exposure during oil shale mining activities.

Coal

Low grade coal resources may be unavoidably lost due to mixing with overburden material during surface mining activities and left in the pit margins in all alternatives except the Wildlife Alternative.

Oil and Gas

Oil and gas resources may be unavoidably lost due to oil shale open pit mining in all alternatives. This loss would be greatest in the Oil Shale Alternative whereas it would be least in the Wildlife Alternative.

Topography

Oil shale open pit and extensive oil shale and coal underground mine subsidence could remove or alter some topographic features and create new modifications to the topographic character of the Piceance Basin.

Floodplains and Alluvial Valleys

Water quantity and quality may unavoidably and adversely be lost or degraded in alluvial valleys and floodplains due to mine dewatering, subsidence or aquifer mixing. This would be the result of oil shale, sodium or coal development in all alternatives. Oil shale open pit and coal surface mining could cause the greatest unavoidable adverse impacts to these resources in all alternatives except the Wildlife Alternative.

Agricultural Lands

Surface disturbance on agricultural lands would be an unavoidable impact to agricultural production.

Soils

An undetermined acreage would be affected by energy development, disturbances and the construction of facilities. Soils would be removed from vegetation production until successfully rehabilitated. Soil erosion would be accelerated on disturbed, unvegetated areas. Surface disturbances on unstable fragile soils and steep slopes would dramatically increase the potential for accelerated erosion and mass wasting such as landslides.

Hydrology

The potential for ground and surface water quality degradation is greatest under the Oil Shale Alternative especially if in-situ retorting takes place. Springs and wells may be unavoidably lost due to mine dewatering. The flows of the White River could be significantly reduced annually by as much as eleven percent due to oil shale development in the Oil Shale Alternative.

Vegetation

Vegetation Types

The major adverse impact would be a short and long-term loss of vegetation cover from oil shale

and oil and gas development. In the case of oil shale open pit mining and refuse disposal areas, the native plant community may be permanently lost.

Threatened, Endangered, Rare and Sensitive Plant Species and Remnant Vegetation Associations

Surface disturbance and secondary impacts are inevitable with the development of oil shale, sodium, oil and gas and coal resources. Adverse impacts would result if surface disturbances occur on sites inhabited by rare and sensitive plants and remnant vegetation associations. The severity of impacts depends on the location of development and the success of avoidance efforts.

Livestock Grazing

Surface disturbance, especially in the Oil Shale and Oil and Gas Alternatives, would result in a short and long-term loss of forage on the lease tracts.

Wildlife

Surface disturbance and human encroachment is inevitable with the development of oil shale, coal, sodium, oil and gas resources. Surface disturbance results in wildlife forage and cover losses which reduces habitat carrying capacity. Human encroachment would displace wildlife to adjacent non-impacted areas. The severity of impacts depends on the quantity and type of development and the success of mitigation efforts.

Unavoidable secondary impacts from additional energy development projects include urban expansion, increased recreation-related disturbances to wildlife, poaching, and increased vehicle travel/ roadkills.

Wild Horses

Surface disturbance, especially in the Oil Shale and Oil and Gas Alternatives, would result in a short and long-term loss of forage. Oil shale development could permanently displace 75 wild horses from their preferred habitat within the Piceance Herd Management Area. Displacement would most likely occur in the Oil Shale Alternative.

Cultural Resources

Destruction or loss of cultural resources could occur if inadvertent disturbance to previously undetected subsurface archaeological sites takes place during construction associated with project development. Possible vandalism due to increased human activity would also be an unavoidable adverse impact.

Paleontological Resources

Many fossils could be destroyed during the construction phase, because they might not be seen due to their size. Since similar fossils probably occur in areas outside the sites, the loss would be small.

During shaft sinking, drifting or crosscutting, the loss of fossils would represent a greater loss to science because their salvage is practically impossible under these conditions.

Recreation

Development of oil shale and oil and gas will inevitably increase opportunities for access, but also eliminate public access from active development areas. Increased human activity, noise, number of people recreating, and surface disturbance would adversely affect big game herds, which in turn would decrease hunting quality in terms of success rate, safety, solitude and sightings. Closures and ORV restrictions would have both positive and adverse impacts by limiting access and providing a non-motorized opportunity that has not existed before in Piceance Basin. Overall, except for the Current Management Alternative, the recreation resource would benefit from proposed management.

Visual

There are significant unavoidable visual impacts in every alternative -- especially short-term impacts. Surface disturbance as described in each alternative can only be partially mitigated, lowering the visual contrast perhaps five to twelve points. Acceptable contrast levels in any class can still have visible scars left in the landscape. Even minor surface disturbances can take five or more years to recover since natural species vegetative growth is slow in the basin.

Social and Economic

At the local, county or state level, adverse social impacts may not be permanent. Economic elements tend to be in the process of continual adjustment. Communities do catch up on street paving and sewer capacities.

Most economic impacts can be avoided or mitigated through planning, monitoring, changes in project schedule or configuration and timely and sufficient provisions of financing. A major exception to this is the extreme vulnerability of the local economy and local governments to the effects of premature closure or a slowdown of project development. It is unlikely that such effects could be completely avoided or mitigated.

Individuals and groups who do not benefit, however, may be permanently disadvantaged. A divorce which results from frustrations with transiency or community rejection, a small business that goes defunct when a chain franchise comes in, an elderly renter forced to move in with his/her child's family because of rising costs of housing, a rancher who has to cut back on his operations because his hired hands have left for higher pay in the mine, a school boy who becomes delinquent -- these may be permanently hurt or destroyed because of the social disruptions. A small town ethos may be lost if cultural diversity is thrust upon it. Political leaders at any level may suffer political loss though attitude changes among the people. These types of losses would occur through all alternatives to the vulnerable persons and groups.

Noise

If pipelines for shale oil products and a rail transportation system for sodium products are not built, increased noise levels could be expected along the major transportation routes and could significantly impact residences within 500 feet of the major transportation routes. This impact would be least for the Wildlife Alternative and cumulatively greatest for the Oil Shale Alternative.

Transportation

Even under baseline conditions of the Current Management Alternative, road deterioration could take place. Traffic accidents and fatalities could occur. Secondary roads could continue to proliferate throughout the Piceance Basin. Unavoidable transportation impacts could be least for the Wildlife Alternative and greatest under the Oil Shale Alternative.

Net Energy

Use of secondary sources of energy such as coal and oil and gas resources may unavoidably be used for the development of a shale oil energy source.

The Relationship between Short-term Use of the Human Environment and the Maintenance and Enhancement of Long-term Productivity

Air Quality

Air pollution during the life of oil shale, coal or sodium mining may result in cumulative, long-term impacts to human health and vegetation. While short-term effects are thought to be insignificant, not enough is known about the long-term effects of air pollution to accurately predict their impact.

Minerals

Oil Shale

Approximately 20 to 26.6 billion barrels of oil shale may remain unrecoverable for the long-term due to present mining techniques in the Current Management Alternative. In all other alternatives 60 to 70 percent of the oil shale may also be left unrecoverable by present mining techniques. The amount of oil shale left unrecoverable would be greatest under the Oil Shale Alternative. However, in the Wildlife, Oil and Gas, and Preferred Alternatives more oil shale (with the exception of open pit mining extraction) would be left in place for future extraction at possibly higher recovery rates due to improvements in mining-retorting technology.

Sodium

Development of sodium resources may result in decreased productivity over the long-term due to present mining technology. However, in the Oil and Gas, and Preferred Alternatives more sodium production may be realized in the long-term due to possible advances of multimineral mining technology.

Coal

Short-term production of coal may be decreased in the Wildlife Alternative due to the restriction on

coal surface mining. Long-term production may be delayed or lost in the Oil and Gas Alternative. Coal production could be unavoidably delayed or lost due to the priority of oil and gas development over coal in all alternatives.

Oil and Gas

Long-term productivity of oil and gas resources may be decreased in all alternatives (Wildlife Alternative excepted) where oil shale open pit mining is allowed. However, short-term productivity of oil and gas will increase in the Oil and Gas Alternative. Designation of 12 potential Special Management Areas in the Wildlife Alternative may also result in an additional loss of oil and gas production.

Floodplains and Alluvial Valleys

Water quantity and/or quality to alluvial valleys and floodplains (if modified) may be lost or degraded due to mine development activities; thus agricultural lands dependent upon these waters may be lost over the short-term. Cessation of mine dewatering activities does not guarantee that water quantity and/or quality over the long-term will be restored to the alluvial valleys or floodplains and may permanently impact agricultural lands dependent upon alluvial valleys for water.

Agricultural Lands

Surface disturbance reclaimable within several years would be a short-term impact. However, surface disturbance required for facilities such as roads, drill pads, or compressor stations would be a long-term impact to agriculture lands and their productivity.

Soils

The absence of vegetative cover in disturbed areas would result in the loss of mycorrhizal fungi populations over the long-term (Reeves et al 1982).

Alteration of the soil profile would disrupt the nutrient and energy cycling, increase soil erosion rates, lower soil fertility levels, and reduce soil productivity over the long-term.

Compaction of the soil would require many years of freeze-thaw and wetting-drying cycles to loosen up the compacted soil layers.

Unsuccessful rehabilitation of the disturbed areas would also result in long-term losses of soil productivity.

Hydrology

Short-term use of groundwater for agricultural use may be lost due to oil shale development usage. Long-term water degradation could be greatest under the Oil Shale Alternative and least under the Wildlife Alternative. Long-term water quality may be degraded by sodium solution mining. Surface waters may be degraded in the short-term due to intensive surface disturbing activities in the Oil and Gas and Oil Shale Alternatives. Flow of the White River could for the short-term be reduced annually by approximately eleven percent due to oil shale development in the Oil Shale Alternative.

Vegetation

Vegetation Types

The long-term stability and productivity of the vegetation resource would be enhanced in areas without energy development.

Oil and gas development would alter both the pinyon-juniper and big sagebrush communities over the long-term. These alterations would be relatively dispersed and probably would be consistent with present man-induced modification of the natural environment.

Oil shale development could seriously compromise the long-term productivity and stability of the native plant communities. This long-term impact would occur principally in the pinyon-juniper and sagebrush vegetation types. Due to the concentration and total nature of the disturbances associated with open pit mining, ecotypes of plant species which occur in the two plant communities could be totally eliminated.

Threatened, Endangered, Rare and Sensitive Plant Species and Remnant Vegetation Associations

Impacts from surface disturbances and the loss of habitat for rare and sensitive plants and remnant vegetation associations would be considered long-term because of the inability to reclaim remnant vegetation associations to their original condition and the lack of present data for the reestablishment of sensitive plant species during the reclamation process.

Nearby urban development and the construction of new roads in areas of known rare and sensitive plants and remnant vegetation associations, could cause a permanent loss of habitat. Unsuccessful reclamation of disturbed sites would result in less

suitable habitat and greater offsite impacts caused by wind and water erosion. This is especially applicable to open pit mining areas and spent shale disposal sites where long-term reclamation has not yet been attempted.

The replacement of introduced species through reclamation or through invasion by weedy annuals on disturbances may create a long-term impact resulting from increased competion to rare and sensitive plants.

Cumulative impacts could lead to the Federal listing of these plants as threatened or endangered.

Livestock Grazing

Enhancement of the vegetation resource would benefit livestock forage production and availability in areas not impacted by energy development.

With suitable mitigation and reclamation of oil and gas generated surface disturbance, long-term livestock forage productivity could be enhanced.

Through reclamation, long-term productivity of forage for livestock could be improved in some areas disturbed during oil shale development; although, it would be questionable whether any viable livestock unit would still exist that could economically utilize this forage.

Forestry

The areas identified for surface coal mining and open pit oil shale leasing, which contain commercial forest land, could seriously affect the long-term productivity of the forest resource by: (1) removing many prime acres from production for a long period of time, and foregoing the opportunity to harvest these stands in an orderly fashion for forest products; and (2) seriously affecting the long-term management plans of the White River Resource Area forestry program, since alternate areas would need to be selected for harvest.

Wildlife

Urban development and construction of new road systems would cause a permanent loss of wildlife habitat. Unsuccessful reclamation of disturbed sites would result in areas of less forage production and lower overall habitat quality. This would especially be applicable to open pit mining areas and refuse disposal sites where large scale reclamation has yet to be attempted. Replacement of usable wildlife cover and browse would be a long-term impact due to the time necessary for adequate reestablishment.

Wild Horses

Enhancement of the vegetation resource would benefit wild horse habitat and forage availability in areas not impacted by energy development.

Long-term wild horse forage availability could be enhanced with suitable mitigation and reclamation of oil and gas activities. Some long-term alteration of wild horse patterns of distribution and movement would inevitably result from development of oil and gas.

The long-term impact from oil shale development on wild horses, particularly in the C-a area would be displacement of horses from preferred habitat and consequent restriction of their free-roaming behavior due to reduction in their range. The result would be a reduction in the health and viability of the herd.

Cultural Resources

The majority of impacts to cultural resources could occur as a result of surface disturbance from oil shale development. If destruction of cultural sites results, this would create a permanent loss of data.

Paleontological Resources

Loss of paleontological resources through surface and subsurface disturbance would significantly affect the scientific value of the resource in the long-term if steps are not taken to salvage exposed fossils. If left unprotected, they would eventually be lost through weathering or vandalism. This is especially true of the vertebrate, rare plant and late Eocene insect fossils.

Recreation

Once oil shale and oil and gas activity has ceased within the basin, rehabilitation efforts should resolve many of the adverse impacts occurring to the recreation program. Big game hunting would probably come back at a slow rate.

Visual Resources

Major surface disturbances such as utility corridors, roads, disposal areas, mine pits, buildings, etc., would cause long-term impacts beyond the life of the project, and may well last through the 21st century.

Social and Economic

Each anticipated oil shale project would require significant short-term use of financial and human resources to develop the project and to accommodate associated population and community growth. The successful project will result in the long-term enhancement of national economic productivity through the provision of a new energy and income source.

The proposed actions would have many short-term social impacts through individual and group vulnerability to change. In the long run, new attitudes, new businesses, new values and norms, new definitions of social reality, new ways, and new friends would replace the old and return individuals and communities to some relatively comfortable rate of economic and social change, though never back to the original states of the past.

Noise

Long-term noise increases may be expected in remote areas if production of oil and gas resources is established from exploration activities. Short-term noise increases may be expected in remote areas due to exploration activities. These impacts would be greatest under the Oil and Gas Alternative. Oil shale mineral development would increase noise impacts for the long-term and will be greatest under the Oil Shale Alternative.

Long-term noise impacts could change wildlife patterns in the Piceance Basin Planning Area.

Transportation

Increased road use, especially for truck haul of mineral products could increase road maintenance costs and eventually the cost could be passed on to taxpayers in the long-term. Increased costs could be offset by increased local and regional productivity and by national energy independence in the long-term.

Net Energy

Short-term use of secondary sources of energy such as coal and oil and gas would be expended for the long-term production of shale oil as an energy source.

Irreversible or Irretrievable Commitment of Resources

Air Quality

Some degradation of air quality will be irreversible due to established urbanization in the area after closure of the oil shale facilities.

Minerals

Oil Shale

Approximately 18.9 to 25.5 billion barrels of oil shale could be irretrievably lost due to its production into shale oil. Unrecovered oil shale could be irretrievably lost due to unfavorable economics in returning to a previously mined area.

Conflicts with oil and gas and sodium only development may result in an additional irretrievable loss of oil shale resources. This impact is potentially greatest under the Oil Shale Alternative.

Sodium

Fifty to 80 percent of the sodium resources on existing leases could be irretrievably lost in the Current Management, Wildlife and Oil Shale Alternatives due to the leasing and development of just sodium minerals with present mining technology.

Coal

Coal resources may be permanently lost due to the prior development of oil and gas resources.

Oil and Gas

More oil and gas resources could be irretrievably lost in the Oil Shale Alternative than all the other alternatives due to the extensive oil shale open pit and underground mine priority area.

Topography

Certain topographic features of the Piceance Basin will be irretrievably lost due to oil shale open pit, coal surface, and sodium solution mining. Underground mining techniques may cause significant alteration of some features due to subsidence.

Floodplains and Alluvial Valleys

Mine dewatering, subsidence, and/or aquifer mixing may irreversibly affect water quality and quantity in the alluvial valleys and floodplains. These effects could irretrievably preclude agricultural practices or irreversibly alter the natural and beneficial effects of these areas.

Agricultural Lands

Permanent loss of agricultural lands and production from surface disturbing activities and urban development would be an irreversible and irretrievable impact.

Soils

Loss of topsoil is inevitable on the disturbed areas due to wind and water erosion. The soil lost from steep, unvegetated slopes would be irretrievably displaced for use in reclamation.

Loss of site productivity from mass wasting would be an irreversible impact. The impacts of complete soil horizon differentiation, would be irreversible. The disruption of the soil profile and introduction of new parent materials would decrease soil community diversity and create new soils with altered soil structures and texture.

Soil pH and clay content would be irreversibly changed due to handling of the topsoil (Verma and Thames 1975). Permeability, infiltration rates and effective rooting depths would be decreased. Toxic elements encountered during mining and brought to the surface would be incorporated into the soils.

Hydrology

Groundwater usage for oil shale production could irretrievably deplete groundwater sources used for agriculture in the Current Management, Oil and Gas and Preferred Alternatives. Water quality of both aquifers, Piceance and Yellow Creeks may irreversibly be degraded due to sodium solution mining, and in-situ recovery of shale oil.

Vegetation

Vegetation Types

Ecotypes of plant species within the sagebrush and pinyon-juniper plant communities could be eliminated by oil shale development. The native plant communities as they are now known could be irreversibly altered, principally by open pit mining of oil shale.

Threatened, Endangered, Rare and Sensitive Plant Species and Remnant Vegetation Associations

Impacts to the habitats of rare and sensitive plants and remnant vegetation associations from construction of new road systems, mine facilities, surface mining, urban expansion, timber harvest and grazing would be an irreversible and irretrievable resource commitment.

Livestock Grazing

Livestock forage lost during the period from initial surface disturbance to final reclamation would be an irretrievable impact. This impact could be further compounded if this forage loss forces a permittee to terminate his livestock operations.

Wildlife

Habitat lost to urban expansion and construction of new road systems would be an irreversible and irretrievable resource commitment. Present wildlife habitat could be irreversibly altered primarily from oil shale open pit mining and refuse disposal areas. Displacement of disturbance-intolerant species could result in an irreversible, irretrievable impact.

Wild Horses

Wild horses' habitat could be irreversibly altered from oil shale development. This could have the irreversible effect of creating an inviable breeding population of wild horses.

Cultural Resources

Destruction of cultural resources would result in an irretrievable loss of additional information to the existing scientific data base.

Paleontological Resources

The paleontological resources are non-renewable; once lost or destroyed they are irretrievable. It is important that at least a representative sample of the fossil record be preserved.

Recreation

Increased use of the recreation resource would probably remain even after activity declined and populations shifted out of the region. Recreation opportunity spectrum classes which shift from semi-primitive motorized to modern urban or rural would likely never return to semi-primitive motorized, even with rehabilitation. Instead, they might change to roaded natural or stay in modern urban or rural.

Visual Resources

Disposal areas, and perhaps mine pits (if never filled by other operations) would always be evident in the landscape. Present technology limits the ability of operators to economically imitate natural landforms.

Noise

Long-term noise impacts from mineral development could cause an irretrievable loss of wildlife numbers within an area adjacent to the mineral development, for the duration of that development. However, the loss of wildlife numbers due to noise would not be irreversible once the noise stops.

Transportation

Increased use of highways would result in increased traffic accidents and fatalities proportional to the rate of mineral production under each alternative. Highway construction and improvements would commit a quantity of sand and gravel resources to this purpose.

Net Energy

Secondary sources of energy such as oil and gas, and coal will be irreversibly expended in the construction and operation of oil shale resource production.

Mitigation Measures that could further Ameliorate the Anticipated Impacts but are not required by BLM (Uncommitted Mitigation)

Air Quality

Residual air quality impacts could be mitigated through additional control of emissions from existing sources. Increased study of pollution impacts to Air Quality Related Values, and additional background monitoring to better assess regional impacts would assist in better understanding of air quality problems associated with oil shale development in the Piceance Basin.

Minerals

Sodium

Restrict sodium mining on the existing leases, PRLAs and on future leases in the Current Management, Oil and Gas, and Preferred Alternatives to avoid mining zones rich in oil shale. This would include designing any sodium mine plans to minimize the damage to future oil shale extraction.

Hydrology

Identify sensitive watersheds for protection against degradation related to oil and gas development activities. Public and private water rights would have to be preserved and protected by the Colorado State Government.

Wildlife

An industrial association would be established to mitigate wildlife impacts on a regional basis. Among those recommended for participation are the affected government agencies (BLM, Division of Wildlife, U.S. Fish and Wildlife Service), existing and future mineral (oil shale, sodium, coal, oil and gas) lease holders, and other associated development companies in the Piceance Basin. The objectives of this association would include but are not limited to:

1) Provide an avenue for coordination between involved companies and agencies to prevent duplication of required efforts in compliance with environmental stipulations.

2) Initiate a team effort to identify adverse impacts and mitigation of cumulative consequences to the wildlife resource from development.

3) Establish a trust fund to finance field surveys, research projects and mitigation efforts. This would equally distribute costs among companies involved when monitoring and attempting to mitigate cumulative impacts.

4) Allow interchange of equipment, technology and information between companies for monitoring and mitigation of impacts to the wildlife resource.

Mass transportation of employees would be recommended whenever feasible to decrease the number of vehicle/wildlife accidents.

Cultural Resources

A monitoring program to observe the effects of subsidence from oil shale development on cultural resources could provide data which would be used to protect cultural sites in the future. A geomorphological study would be conducted prior to any oil shale development to provide a data base which would be utilized for determining the environmental relationships of cultural resources throughout the planning area.

Paleontological Resources

To further evaluate the quality and extent of the paleontological resources in the area; it is recommended that an intensive paleontological survey be conducted of the Piceance Basin. Areas where intensive surface disturbance associated with mineral development should be surveyed first.

Recreation

Decreases in public land accessibility could be compensated for by opening private lands held by companies responsible for such closures.

Cooperative agreements with Colorado Division of Wildlife and Rio Blanco County Sheriffs Department to provide additional patrol and visitor services and be reimbursed by companies responsible for sudden influxes of people utilizing the recreation resource.

Visual Resources

Reshape disturbed lands to imitate natural landforms. This would reduce contrast to landforms by about 30-50 percent. Contrast to landform is the most significant of all for the major surface disturbing activities.

Social and Economic

Social and economic mitigation involves measures that would reduce the scale of economic and social impacts, allow time for planning to accommodate impact, and provide financing for the increased capital and operating expenses that would be required.

Although specific economic mitigation measures are not described here, the types of mitigation measures available and the impacts they address include the following.

- Single-status camps for workers temporarily employed can significantly reduce the employment, income and population impacts of a project. The broader social impacts could also be lessened to the extent that these camps address recreational and other social needs of camp residents.

- Phasing of project development can reduce its scale at any one time and hence its impacts. It would also allow more time for planning.

- Programs to provide incentives to builders and to project employees could encourage location of the workforce in areas most willing and able to accommodate growth.

- Prepayment of property and severance taxes to affected jurisdictions could assure some financing for capital facilities when it is most needed.

- Direct contributions of funds, equipment and personnel could be provided.

The fact that the socioeconomic impacts to be mitigated would be generated by development of Federal oil shale resources could simplify mitigation efforts. In the first place, the Federal leases will generate Federal bonus monies almost immediately and Federal royalties after commercial production is begun. Current law provides allocation of 50 percent of these monies to the state affected jurisdictions. This is a source of funds not available during the development of private resources. The bonus money in particular could be useful as it is available early in the project's life when expansion, and hence financing, is most needed. The amount of maximum bonus required for lease purchase is currently tied to fair market value but consideration could be given to program and legislative changes that either require a minimum bonus that reflects financial needs of affected communities or that would distribute more of the share of bonus monies to those communities.

Secondly, the Federal lease stipulations could be structured so that a phased, reduced impact would result. Legislative changes would likely be required in this area as well.

Social impacts may be difficult to mitigate. Social services agencies typically have low priority in funding, but these are among the most important mitigators. In western Colorado, these agencies have formed County and Regional Human Resource Councils aimed at identifying local human services needs, gaps in fulfillment of these, sharing ideas for better ways of serving their communities, and ob-

taining funding especially in the face of cuts in Federal monies. Communities could call on these councils and their member agencies for information and guidance in meeting services delivery needs, and could be more strongly committed to funding these less tangible but no less essential services along with allotting money for the more visible needs such as street paving and sewer expansion.

Efforts could be made to identify and welcome new arrivals to the communities (for instance, through cooperation with hiring officials), and to get them involved in community activities. Some northwest Colorado Human Resources Councils have put together community resources booklets for distribution to newcomers and these help new families become socially oriented. A social outreach program has been started in Garfield County and this type of project is very helpful. Churches and clubs have many opportunities to encourage participation and otherwise to make transients and new residents feel at home.

As identified earlier, energy development produces both winners and losers. An effort must be made to identify these groups. Communities could then examine the social change processes and, understanding these, could seek to direct them so as to minimize adverse impacts and maximize benefits.

Additional measures recommended for dealing with boom growth are identified in the Green River-Hams Fork Final Coal Environmental Impact Statement (USDI, BLM August 1980).

All mitigation efforts would be more effective if carried out cooperatively by all the public and private interests involved.

Noise

Use of pipelines for the transport of shale oil as opposed to heavy truck transport could considerably reduce noise impacts along major transportation routes.

Transportation

To offset the cost of damage to highways from heavy truck traffic hauling mineral products, highway users could be required to contribute 1.4 cents per ton per mile over and above normal tax and license fees.

Net Energy

The development of alternate sources of onsite power generation, such as low BTU off-gases to assist in the power demands for shale oil production could decrease the need for imported electricity.

Chapter V
Consultation, Coordination and Consistency

CHAPTER V
CONSULTATION, COORDINATION AND CONSISTENCY

In the course of preparing this Resource Management Plan, considerable formal and informal efforts have been made to involve the public, other Federal agencies, and state and local governments in the planning process. Several points of public input are mandated by regulations, and were complied with, but numerous other actions were taken to further involve the public.

Public Participation

The planning process began in August 1982 with issue identification. Public meetings were held and written comments were solicited to determine the scope of the document and identify the concerns of the public that should be addressed in the RMP. These issues are included in Chapter I.

In the following months, workshops were conducted with various special interest groups and organizations. A meeting was held with representatives of the State of Colorado. The county commissioners and planning commissions of Rio Blanco and Garfield Counties were brought up to speed at their regularly scheduled meetings. A mailing list of over 1,000 individuals, organizations and government entities was developed so that all interested parties could be kept up to date as the RMP evolved.

The primary means of keeping the public informed was through the *White River Report,* a newsletter that seeks to share information and encourage public participation in the planning process. By April 1983, the planning issues and planning criteria were made available to the public for review.

In September 1983, the resource management alternatives were developed, and the next major phase of public involvement began. Workshops were again held and meetings with state and county officials were conducted to describe the alternatives and obtain comments on them. By January 1984, the Preferred Alternative was developed. A select work group made up of representatives of industry, environmental groups and state and local governments was convened and asked to review the Preferred Alternative, and their comments were incorporated.

Publication of this Draft Resource Management Plan begins another phase of critical public involvement. Comments on the Draft RMP will be considered and incorporated into the Proposed Resource Management Plan and Final EIS scheduled for release in November 1984.

Formal Consultation

This is consultation that is required by regulations to formally involve agencies with specific expertise in the environmental or planning process. At this level of analysis, most of these requirements do not apply, since a specific project development is not proposed. However, some formal consultation did occur.

Interagency consultation was initiated with the U.S. Fish and Wildlife Service by requesting a list of threatened or endangered species to be considered in this Resource Management Plan. BLM will submit a biological assessment based on this Draft RMP/EIS for a biological opinion. This biological opinion and any recommendations provided by the U.S. Fish and Wildlife Service will be included in the Final EIS.

The Regional Oil Shale Team, an advisory group comprised of representatives of the governors of the oil shale states (Colorado, Utah and Wyoming), and the BLM State Directors of those states, were formally involved in issue identification at the outset of the process. They were consulted again in a formal review of the resource management alternatives considered prior to development of the preferred alternative. They will again be formally consulted on the Draft RMP.

Consultation with the State Historic Preservation Officer will be initiated with the distribution of the Draft RMP.

The Western Utility Group and individually affected companies were consulted concerning proposed and existing utility land use needs based on the May 1980 Western Regional Corridor Study. Of those companies consulted, only two responded with potential utility land use needs. Their needs have been considered in the RMP.

Consultation with the Governor of Colorado will be initiated prior to approval of the RMP. The Governor shall be given 60 days to identify inconsistencies and provide recommendations to the BLM Colorado State Director as required by 43 CFR 1610.

CONSULTATION, COORDINATION AND CONSISTENCY

Coordination

The State of Colorado has been involved from the beginning of the planning process in providing issues to be addressed, formulating and reviewing alternatives (including the preferred), and reviewing other portions of the analysis.

The Colorado Division of Wildlife and U.S. Fish and Wildlife Service provided information and valuable technical assistance in developing the wildlife sections of this document. The Environmental Protection Agency, U.S. Forest Service, National Park Service, Soil Conservation Service and other Federal agencies have also been involved in various phases of review and comment on the plan.

Rio Blanco and Garfield Counties have been involved from the outset, in an attempt to coordinate the decisions of the Resource Management Plan with the plans, policies and goals of those counties.

Considerable coordination has been required within BLM as well, particularly with adjoining BLM Districts where Resource Management Plans are currently underway, specifically in the Vernal District in Utah, and the Grand Junction District in Colorado.

Numerous other local, state and Federal agencies have been contacted throughout the process. Most are listed in the Distribution List at the front of this document.

Consistency With Other Plans

None of the proposed alternatives would directly conflict with the objectives of other Federal, regional, state or local land use plans, policies or controls for the area. Permitting and other controls are established at each of these levels which must be complied with in order to avoid unexpected impacts that may indirectly result from implementation of the decisions that come out of this plan. Some BLM plans and decisions may have to be modified as a result of this RMP, but those are addressed in this document.

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Appendices

APPENDIX A
SOCIOLOGICAL STUDIES

Study of Women in Meeker

Selected items from the longitudinal study of women in Meeker by the Growth Impact Group (Moen 1983) are shown in Table A-1. Those women who had lived in Meeker for less than five years tended to be less satisfied with their living conditions, their neighborhood, and with community facilities and services than were longtime women residents, though differences are not very great, and there are notable exceptions (such as traffic, animal control, mental health and the local high school).

When compared with women of a control town which is somewhat smaller and more isolated, the satisfaction levels do not follow a consistent trend. Women in that town frequently expressed less satisfaction than their counterparts in the test town (Meeker), and long term women residents were frequently less satisfied than were the more recent arrivals.

This evidence demonstrates that, contrary to popular perceptions, 'boom' town life may not automatically lead to a more negative perception of the quality of life nor is it clear that newcomer women, one of the greatest at-risk groups, necessarily feel less satisfied than do oldtimer women.

The table suggests further confirmation of the work of Freudenburg and others (see especially the Pacific Sociological Review, July, 1982, entire issue), that some of the problems attributed to boom towns (e.g., fear for safety, health, alcohol and mental health services) may be less significant than is often supposed.

BLM Study of Rifle

Additional findings of the 1981 BLM study based on a random sample of 109 persons in Rifle indicate that 29 percent of the respondents felt that local communities have no influence on whether energy production occurs in the area, 41 percent felt they had very little influence, 13 percent said some, and 17 percent said a lot. In-depth interviews with 22 of the respondents revealed, however, that some persons do not believe the local community should have much influence in such decisions. The most common view expressed was that a community should not be able to stop development, but should be able to impose mitigative restrictions on the companies.

Of things liked most about living in Rifle, respondents most often mentioned friendliness of the people, natural beauty of the area, climate, outdoor recreation and small size of the town. Those holding energy-related jobs and newcomers were less likely to mention friendliness of the people. Newcomers often felt that they were not warmly received by the town and that longtime residents were too suspicious of them.

In-depth interviewees ranked wildlife as a highest priority among BLM responsibilities, with watershed second. The other four choices (range, timber, recreation, and energy and minerals) ranked about equally.

TABLE A-1

SELECTED COMPARISONS OF WOMEN SATISFIED AND DISSATISFIED WITH COMMUNITY ELEMENTS, BY LENGTH OF RESIDENCE, IN PERCENTS

Community Element	Meeker Women				Control Group Women			
	Satisfied		Dissatisfied		Satisfied		Dissatisfied	
	≤5 yrs Res.	*>5 yrs Res.*	*≤5yrs Res*	*>5 yrs Res.*	*≤5 yrs Res.*	*>5 yrs Res.*	*≤5 yrs Res.*	*>5 yrs Res.*
Home	76	85	17	8	82	84	12	8
Neighborhood	77	82	15	9	83	81	9	9
Town	61	65	26	19	57	52	23	26
Neighborhood Stress:								
Nothing	14	7	.....	.....	7	8		
Crowding	.....	.....	19	18	.....	.....	16	10
Traffic	.....	.....	19	25	.....	.....	9	10
Animals	.....	.....	32	41	.....	.....	28	39
Problem Children	.....	.....	12	9	.....	.....	5	10
Fear	.....	.....	3	1	.....	.....	0	0
Services:								
Hospital	39	58	25	21	38	65	18	38
Employment Service	40	39	9	1	16	5	26	10
Mental Health	24	37	4	8	15	25	15	8
Alcohol Treatment Facilities & Programs:	7	8	2	1	11	9	11	0
Police	57	67	12	8	47	33	32	36
High School	35	53	20	27	39	52	29	27
Restaurants	13	19	75	59	23	29	58	56
Recreation (adult)	11	30	48	30	19	28	46	27
TV	35	61	53	26	14	22	72	68

N≤5 yrs Residence Meeker=143
N>5 yrs Residence Meeker=135
N≤5 yrs Residence Control=56

N > *5 yrs Residence Control = 95*
Source: Moen, Betsy. 1983 "Community Satisfaction". Growth Impact Group, Program on Population Processes, Institute of Behavioral Science. University of Colorado. Boulder, Colorado. Tables 1, 5, 7, 8 (partial) (Percents rounded).

TABLE A-2

PICEANCE BASIN TOTAL POPULATION EFFECTS 1985-2000, ALL ALTERNATIVES

Year	Base-line	% Chg Bet. yrs.	Wildlife Altern.	Current Management Alternative					Oil and Gas Alternative					Oil Shale Alternative				
				Pop. Added	Total	%Chg Bet. yrs.	%Dif. Altern. Base-line	% Add. Base-line	Pop. Added	Total	% Chg Bet. yrs.	% Def. Altern. Base-line	% Add. Base-line	Pop. Added	Total	% Chg Bet. Yrs.	% Dif. Altern. Base-line	% Add. Base-line
SILT																		
1980	916	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....			
1985	1,787	.....	No effects before year 2000...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,787			
1986	1,742	-3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7	1,749	-2	1	0
1987	1,814	+4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	22	1,836	+5	1	1
1988	1,929	+6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	37	1,966	+7	1	2
1989	2,017	+5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	52	2,069	+5	0	3
1990	2,010	-0	.....	.....	.....	.....	.....	.....	.....	2,010	.....	.....	.....	71	2,081	+1	1	4
1991	2,020	+1	.....	.....	.....	.....	.....	.....	10	2,030	+1	0	1	131	2,151	+3	2	6
1992	2,158	+7	.....	.....	.....	.....	.....	.....	19	2,177	+7	0	1	170	2,328	+8	1	8
1993	2,399	+11	.....	.....	.....	.....	.....	.....	35	2,434	+12	1	1	221	2,620	+13	2	9
1994	2,360	-2	.....	.....	.....	.....	.....	.....	44	2,404	-1	1	2	258	2,618	-0	2	11
1995	2,376	+1	.....	.....	2,376	.....	.....	.....	63	2,439	+1	0	3	293	2,669	+2	1	12
1996	2,397	+1	.....	6	2,403	+1	0	0	93	2,490	+2	1	4	321	2,718	+2	1	13
1997	2,418	+1	.....	12	2,430	+1	0	1	118	2,536	+2	1	5	384	2,802	+3	2	16
1998	2,437	+1	.....	22	2,459	+1	0	1	168	2,605	+3	2	7	381	2,818	+1	0	16
1990	2,456	+1	.....	31	2,487	+1	0	1	196	2,652	+2	1	8	391	2,847	+1	0	16
2000	2,473	+1	.....	52	2,525	+2	1	2	256	2,729	+3	2	10	448	2,921	+3	2	18
NEW CASTLE																		
1980	560																	
1985	1,190	.....	No effects before year 2000...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,190			
1986	1,170	-2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	1,173	-1	1	0
1987	1,202	+3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11	1,213	+3	0	1
1988	1,287	+7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	19	1,306	+8	1	1
1989	1,361	+6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28	1,389	+6	0	2
1990	1,363	+0	.....	.....	.....	.....	.....	.....	.....	1,363	.....	.....	.....	37	1,400	+1	1	3
1991	1,381	+1	.....	.....	.....	.....	.....	.....	5	1,386	.....	1	0	71	1,452	+4	3	5
1992	1,511	+9	.....	.....	.....	.....	.....	.....	11	1,522	.....	1	1	100	1,611	+11	2	7
1993	1,591	+5	.....	.....	.....	.....	.....	.....	19	1,610	.....	1	1	127	1,718	+7	2	8
1994	1,523	-4	.....	.....	.....	.....	.....	.....	24	1,547	.....	0	2	147	1,670	-3	1	10
1995	1,532	+1	.....	.....	1,532	.....	.....	.....	34	1,566	.....	0	2	167	1,699	+2	1	11
1996	1,545	+1	.....	3	1,548	+1	0	0	48	1,593	.....	1	3	180	1,725	+2	1	12
1997	1,557	+1	.....	6	1,563	+1	0	0	61	1,618	.....	1	4	216	1,773	+3	2	14
1998	1,568	+1	.....	11	1,579	+1	0	1	90	1,658	.....	1	6	217	1,785	+1	-1	14
1990	1,578	+1	.....	16	1,594	+1	0	1	107	1,685	.....	1	7	225	1,803	+1	-1	14
2000	1,589	+1	.....	25	1,614	+1	0	2	141	1,730	.....	2	9	256	1,845	+2	-1	16
GLEN-WOOD SPRINGS																		
1980	6,888																	
1985	9,930	.....	No effects before year 2000...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9,930			
1986	10,179	+3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	10,182	+3	0	0
1987	10,308	+1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	33	10,341	+2	1	0
1988	10,764	+4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	45	10,809	+5	1	0
1989	11,097	+3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	62	11,159	+3	0	1
1990	11,184	+1	.....	.....	.....	.....	.....	.....	.....	11,184	.....	.....	.....	63	11,247	+1	0	1
1991	11,292	+1	.....	.....	.....	.....	.....	.....	7	11,299	+1	0	0	131	11,423	+2	1	1
1992	12,199	+8	.....	.....	.....	.....	.....	.....	22	12,221	+8	0	0	185	12,384	+8	0	2
1993	12,638	+4	.....	.....	.....	.....	.....	.....	35	12,673	+4	0	0	230	12,868	+4	0	2

APPENDIX A

TABLE A-2—Continued

PICEANCE BASIN TOTAL POPULATION EFFECTS 1985-2000, ALL ALTERNATIVES

Year	Base-line	% Chg Bet. yrs.	Wildlife Altern.	Current Management Alternative					Oil and Gas Alternative					Oil Shale Alternative				
				Pop. Added	Total	%Chg Bet. yrs.	%Dif. Altern. Base-line	% Add. Base-line	Pop. Added	Total	% Chg Bet. yrs.	% Def. Altern. Base-line	% Add. Base-line	Pop. Added	Total	% Chg Bet. Yrs.	% Dif. Altern. Base-line	% Add. Base-line
1994	12,317	-3	.....	.....	.....	.....	.....	.....	36	12,353	-3	0	0	284	12,601	-2	1	2
1995	12,406	+1	.....	.....	12,406	.....	.....	.....	36	12,442	+1	0	0	308	12,714	+1	0	2
1996	12,494	+1	.....	0	12,494	+1	0	0	35	12,529	+1	0	0	312	12,806	+1	0	2
1997	12,578	+1	.....	0	12,578	+1	0	0	33	12,611	+1	0	0	410	12,988	+1	0	3
1998	12,656	+1	.....	-1	12,655	+1	0	0	122	12,778	+1	0	1	498	13,154	+1	0	4
1990	12,729	+1	.....	-2	12,727	+1	0	0	166	12,895	+1	0	1	529	13,258	+1	0	4
2000	12,800	+1	.....	-3	12,797	+1	0	0	266	13,066	+1	0	2	633	13,433	+1	0	5
PARA-CHUTE/ BM																		
1980	757																	
1985	12,796	.....	No effects before year 2000...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	12,796	.....	.....	0
1986	10,417	-19	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16	10,433	-18	1	+0
1987	9,256	-11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	54	9,310	-11	0	1
1988	10,473	+13	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	85	10,558	+13	0	1
1989	11,897	-14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	142	12,039	+14	0	1
1990	10,690	-10	.....	.....	.....	.....	.....	.....	0	10,690	.....	.....	0	166	10,856	-10	0	2
1991	11,373	+7	.....	.....	.....	.....	.....	.....	37	11,511	+8	+1	+0	445	11,919	+10	3	4
1992	12,911	+13	.....	.....	.....	.....	.....	.....	72	12,983	+13	0	1	602	13,513	+13	0	5
1993	14,957	+15	.....	.....	.....	.....	.....	.....	105	14,962	+15	0	1	718	15,575	+15	0	5
1994	14,641	-1	.....	.....	.....	.....	.....	.....	118	14,759	-1	0	1	998	15,639	+0	1	7
1995	14,346	-2	.....	-20	14,326	.....	.....	-0	142	14,488	-2	0	1	1,169	16,616	-0	2	8
1996	14,330	-0	.....	7	14,337	+0	0	+0	176	14,506	+0	0	1	1,211	16,641	+0	0	8
1997	14,643	+2	.....	15	14,658	+2	0	+0	205	14,848	+2	0	1	1,493	16,136	+4	2	10
1998	14,633	-0	.....	27	14,660	+0	0	+0	431	15,064	+1	1	3	1,641	16,274	+1	1	11
1999	14,270	-2	.....	38	14,308	-2	0	+0	527	14,797	-1	1	4	1,696	16,956	-2	0	12
2000	14,247	-0	.....	59	14,306	-0	0	+0	838	15,085	+2	2	6	2,012	16,259	+2	2	14

APPENDIX B
SPECIAL MANAGEMENT AREAS

This RMP considered 12 Special Management Areas (SMAs), incorporating potential Areas of Critical Environmental Concern (ACECs), Research Natural Areas (RNAs), Outstanding Natural Areas (ONAs) and areas of No Surface Occupancy (NSOs). See the Glossary for a detailed explanation of these terms.

Twenty SMAs were identified by The Nature Conservancy, following completion of a rare and sensitive plant inventory of the Piceance Basin, under contract to the BLM. Twelve SMAs were carried through this planning effort that were determined to meet the planning regulation criteria of importance and relevance. Figure B-1 shows the location of these 12 proposed SMAs. These 12 areas were carefully evaluated and analyzed to determine if SMA designation was appropriate, or whether other forms of management were more appropriate based on multiple-use considerations.

All 12 of the proposed SMAs were considered in the Wildlife Alternative. Three high priority SMAs were considered in the Oil and Gas Alternative: Deer Gulch, Dudley Bluffs and South Cathedral Bluffs. In the Preferred Alternative a portion of the proposed Soldier Creek ACEC would be designated with boundary adjustments from the original proposal.

Each SMA is described below in four paragraphs: 1) The "Significant Elements" section describes the species of rare and sensitive plants present, the number of populations, the remnant vegetation associations and their ranking as determined by the Colorado Natural Heritage Inventory; 2) the paragraph on "Management Objectives if Designated" describes the type of proposed SMA designation, acreage, goals of designation and the recommended management actions necessary to achieve the designation objectives as developed by The Nature Conservancy; 3) the "Multiple Use Conflicts if Designated" provides a discussion of the resource conflicts or problems with SMA designation in the Wildlife and Oil and Gas Alternatives; and 4) the final paragraph, "Management in the Preferred Alternative" is a summary of the multiple use analysis and provides detailed recommendations on rare and sensitive plant and remnant vegetation association management in the proposed SMAs as incorporated into the Preferred Alternative. When SMA designation is not proposed in the Preferred Alternative, the alternative management to protect the resource values is described.

The avoidance stipulation, when applied, would incorporate wording to the effect "the habitat of known populations of rare and sensitive plants, and those remnant vegetation associations specifically identified, would be protected from man-induced surface disturbing activities, whenever possible except when prohibited by valid and existing rights." For rare and sensitive plants, the area of protection would include the actual location of the population and, if present, adjacent critical sites that affect their habitat. The development of exclosures and a monitoring program in the Preferred Alternative, would depend on future funding levels. Data from monitoring studies would be used in developing future management recommendations. BLM encourages the assistance of other agencies and environmental groups in monitoring of the rare and sensitive plants and remnant vegetation associations.

Deer Gulch

Significant Elements -- This site includes the largest concentration of populations of *Festuca dasyclada* in the Piceance Basin, two populations of *Aquilegia barnebyi* and one population of *Astragalus lutosus*. The recommended RNA portion of the site contains the only relatively undisturbed perennial stream system flowing through the Green River Formation known in the Piceance Basin. The site also contains four remnant vegetation associations, one occurrence of *Agropyron spicatum var. inerme-Oryzopsis hymenoides* ranked Highest National Priority. One occurrence of *Pseudotsuga menziesii/Symphoricarpos oreophilus/Carex geyeri-Poa fendleriana* ranked Highest State Concern and one occurrence of *Pseudotsuga menziesii/Amelanchier utahensis-Quercus gambellii-Symphoricarpos oreophilus/Carex geyeri-Poa fendleriana* ranked High State Concern and one *Quercus gambellii-Amelanchier utahensis-(Artemisia tridentata-Cercocarpus montanus-Symphoricarpos oreophilus)/Carex geyeri* which is unranked.

Management Objectives If Designated -- Designation would involve the following:

ACEC 956 Acres

RNA 1,171 Acres

NSO 1,508 Acres

Total 3,635 Acres

Festuca dasyclada may be impacted by livestock grazing, therefore, it is important to have an area



SPECIAL MANAGEMENT AREAS

Figure B-1

where this species is protected from impacts as a means of providing a reference area for comparison with grazed populations. Fencing is recommended on the ridge between the ACEC and the NSO portion of the ACEC and also around the RNA to exclude livestock grazing from these two portions of the Deer Gulch site. A monitoring program should then be established to determine if grazing has an effect on the *Festuca dasyclada* population and the *Agropyron spicatum* var. *inerme-Oryzopsis hymenoides* remnant plant association. In the RNA and NSO portions of the ACEC, it is recommended that livestock grazing be excluded, a no surface occupancy stipulation be applied, and the area be excluded from oil shale leasing. A withdrawal from mineral entry and exclusion from leasing is recommended when present leases expire in the RNA portion of the site.

Multiple Use Conflicts If Designated --Nine oil and gas leases cover the entire area, but are not held by unit production. The area also contains areas of commercial forest land. Grazing would be eliminated on about 50 percent of the allotment that includes this proposed SMA. The livestock permittee has completed vegetation manipulations, constructed stock water reservoirs and has built fences over the past years to obtain livestock distribution on the ridges in this allotment which would no longer be available for livestock use. The White River City-Rio Blanco utility corridor crosses the north end of the ACEC.

Management in the Preferred Alternative -- Special Management Area designation would not occur in this area. Exclusion of grazing by fencing was determined unnecessary since the rare and sensitive plants and vegetation associations recommended for protection occur on steep slopes rarely grazed. A limited area will be fenced for monitoring purposes of *Festuca dasyclada* (Utah fescue) populations to document if grazing impacts are occurring. There will be no surface disturbance allowed in populations of*Festuca dasyclada* and *Astragalus lutosus* by application of a no surface occupancy stipulation. Application of the avoidance stipulation will protect the important remnant vegetation association J2002 (*Agropyron spicatum* var. *inerme* and *Oryzopsis hymenoides*) from surface disturbances.

Dudley Bluffs

Significant Elements -- The site contains the type locality and largest population currently known to occur, of a new species, *Physaria obcordata* and five populations of *Astragalus lutosus*. The site also contains three remnant vegetation associations, one *Atriplex confertifolia/Agropyron spicatum* var. *inerme-Oryzopsis hymenoides* ranked Highest National Priority, two occurrences of *Juniperus osteosperma-Pinus edulis/Agropyron spicatum* var. *inerme* ranked High National Priority and two occurrences of *Atriplex confertifolia/Oryzopsis hymenoides* ranked High State Concern.

Management Objectives If Designated -- Designation would be for a 1,603 acre RNA. The site would serve as a reference area for reclamation studies and the taxonomic study of a newly described plant species, *Physaria obcordata*. This site would also serve as a reference area to compare with grazed populations of similar vegetation.

It is recommended the site be formally withdrawn from mineral entry and exlcuded from leasing when present leases expire, excluded from oil shale leasing, designated no surface occupancy and excluded from livestock grazing with installation of a fence where natural barriers cannot be used to exclude livestock.

Multiple Use Conflicts If Designated -- The entire site is covered by eight oil and gas leases. The majority of the site is within the Piceance Creek and Rio Blanco A oil and gas unit, in which the leases are indefinitely held by production. The site also contains approximately 100 acres of pinyon pine and Utah juniper which may be sold for fuelwood. This area is critical livestock winter range and access for trailing cattle is needed up the draws. The Dudley Gulch utility corridor crosses through the northern portion of this site. This site lies within the oil shale open pit mining zone.

Management in the Preferred Alternative -- Special Management Area designation would not occur for this area. The rare and sensitive plants and priority remnant vegetation associations C4007 (*Juniperus osteosperma-Pinus edulis/Agropyron spicatum* var. *inerme*) and F2003 (*Atriplex confertifolia/Agropyron spicatum* var. *inerme-Oryzopsis hymenoides*) would be protected from surface disturbances by incorporating the avoidance stipulation for these sites. Application of the no surface occupancy stipulation would be attempted for known locations of *Physaria obcordata* on the existing oil and gas leases held by unit production. This would involve acquiring an agreement with the lease holders to apply this stipulation to their existing leases.

King Gulch

Significant Elements -- The site contains one population of *Festuca dasyclada* and one population of *Astragalus lutosus*. The site also contains two of the highest known quality occurrences of

Atriplex confertifolia/Agropyron spicatum var. *inerme-Oryzopsis hymenoides* presently known to occur, ranked Highest National Concern and a small, good condition population of *Agropyron spicatum* var. *inerme-Oryzopsis hymenoides* also ranked Highest National Concern.

Management Objectives If Designated -- Designation would involve a 132 acre ACEC. The site would serve as a reference study area for reclamation and to serve for comparative studies on the effects of livestock grazing in areas of similar vegetation. It is recommended the area be designated for no surface occupancy, excluded from oil shale leasing and excluded from livestock grazing.

Multiple Use Conflicts If Designated -- All of the public land in this area is within the Piceance Creek Unit in which the oil and gas leases are held indefinitely by production, therefore a no surface occupancy stipulation cannot be enforced on this site, due to valid existing rights.

Management in the Preferred Alternative -- Special Management Area designation would not occur for this area. Suitable oil and gas drilling locations occur on the ridgetops along the north boundary of this SMA, and should not affect the important plant populations. Enforcement of the avoidance stipulation would offer protection to the rare and sensitive plant populations, without interfering with future oil and gas activities. The excessively steep slopes result in little to no livestock utilization in the area and nullify the necessity for fencing. The *Festuca dasyclada* population 08B086 would be monitored to evaluate the impacts of livestock grazing. The three remnant vegetation associations occurring on the site would also be protected from surface disturbances by applying the avoidance stipulation.

Lower Greasewood Creek

Significant Elements -- The site contains three of the five known Colorado occurrences of *Gilia stenothyrsa* and is the eastern most known occurrence of this taxon. The site also contains a remnant vegetation association of *Juniperus osteosperma-Pinus edulis/Artemisia nova/ Agropyron spicaturm* var. *inerme* ranked High National Priority.

Management Objectives If Designated -- Designation would involve a 203 acre ACEC. Site protection is required to perpetuate *Gilia stenothyrsa* and allow the plant association to recover from past disturbance. It is recommended that livestock grazing be excluded.

Multiple Use Conflicts If Designated -- Three oil and gas leases cover the entire area and are part of the Blair Mesa Unit in which the oil and gas leases are indefinitely held by production. The entire area is also within an oil shale mining claim, the validity of which has not yet been determined. This site is within the Wild Horse Herd Management Area. Fencing to exclude livestock grazing would restrict wild horse movement to water.

Management in the Preferred Alternative -- ACEC designation would not occur for this area. Fencing would not be allowed since it would restrict wild horse movement to water and therefore conflicts with BLM policy. Application of the avoidance stipulation would protect the rare and sensitive plant locations from potential energy development activities. The three *Gilia stenothyrsa* populations (14S039, 14S044, and 14S045) would be monitored to evaluate impacts of livestock grazing..

Lower Hay Gulch

Significant Elements -- The site contains one population of *Astragalus lutosus* and one of the best condition examples of the *Agropyron spicatum* var. *inerme* plant association currently known to occur and is ranked Highest National Priority. The site also contains an example of *Pseudotsuga menziesii/Amelanchier utahensis-Querqus gambellii-Symphoricarpos oreophilus/Carex geyeri-Poa fendleriana* plant association ranked High State Concern.

Management Objectives If Designated -- Designation would involve a 142 acre ACEC. The site is intended to serve as a representative of the *Agropyron spicatum* var. *inerme* grassland in presettlement condition and would be used as a reference area to determine reclamation requirements. The area would be fenced to exclude domestic livestock to compare with the effects of livestock grazing in areas of similar vegetation. A no surface occupancy stipulation would be applied and oil shale leasing would be excluded.

Multiple Use Conflicts If Designated -- The portion of this site which contains the sensitive plant population and the remnant vegetation associations is within the Duck Creek Unit in which the oil and gas leases are indefinitely held by production. The remainder of the area is covered by oil and gas leases which are not part of a producing unit.

Management in the Preferred Alternative -- Special Management Area designation would not occur for this area. Condition of the plant communities and steepness of slopes indicate minimal live-

stock use, therefore, justification for fencing is absent and not recommended. Rare and sensitive plants and remnant vegetation association J1004 (*Agropyron spicatum* var. *inerme*) would be protected by applying the avoidance stipulation on surface disturbing activities within the area.

North Cathedral Bluffs

Significant Elements -- The site contains nine populations of *Aquilegia barnebyi* and four remnant vegetation associations. Three of the best known occurrences of *Artemisia tridentata* ssp. *wyomingensis-Symphoricarpos oreophilus/Elymus cinereus* and two occurrences of *Pseudotsuga menziesii/Symphoricarpos oreophilus/Carex geyeri-Poa fendleriana* are found on the site and both plant associations are ranked Highest State Concern. There is one occurrence of *Pseudotsuga menziesii/Amelanchier utahensis-Quercus gambellii-Symphoricarpos oreophilus/Carex geyeri-Poa fendleriana* ranked High State Concern and *Amelanchier utahensis-Symphoricarpos oreophilus/Carex geyeri* which is unranked also occurs on the site. The southwestern portion of the SMA has outstanding scenic values.

Management Objectives If Designated -- Designation would involve the following:

ACEC 7,479 acres

RNA 571 acres

ONA 682 acres

Total 8,732 acres

The primary purpose of designation would be to secure from mining, a large enough area to represent the full spectrum from mid- to high-elevation vegetation, aquatic features, geologic exposures and scenic values typical of the northwestern margin of the Piceance Basin. The ONA designation is for the scenic view of northwest Colorado. A parking area to the south of the ONA. The RNA designation would be used as an area to conduct scientific research.

The RNA and ONA would be designated for no surface occupancy and would be excluded from oil shale leasing. The RNA would be withdrawn from mineral entry when present leases expire. Livestock grazing would be excluded, therefore, fencing of the RNA is recommended. The four wheel drive road in the ONA that runs out on the ridge to the west would be closed, with all other roads remaining open.

Multiple Use Conflicts If Designated -- Twenty-one oil and gas leases cover the entire area. Most of the area is within the Big Ridge and Sagebrush Hills Units in which the oil and gas leases are indefinitely held by production. The site also contains an active timber sale and additional areas of commercial forest land. It is also partially within oil shale mining claims the validity of which has not yet been determined. The RNA portion of this site is important for trailing cattle from Spring Creek to their summer range and for cattle movements within their summer range. The Calamity Ridge utility corridor intersects the entire ACEC.

Management in the Preferred Alternative -- Special Management Area designation would not occur for this area. Fencing is not recommended due to potential conflicts with livestock grazing and conflicts with trailing. Rare and sensitive plants would be protected using the avoidance stipulation. In addition, no surface occupancy stipulations would be applied when present leases expire to protect the concentration of *Aquilegia barnebyi* (Barneby's Columbine) populations in McDowell Gulch. Consideration would also be provided in the Duck Creek and Spring Creek Allotment Management Plans (AMPs) for trailing cattle to avoid damage to the known rare and sensitive plants and remnant vegetation associations. The scenic qualities of the proposed ONA would be maintained through stipulations on development activities. The four-wheel drive road would not be closed.

School Gulch

Significant Elements -- The site contains two populations of *Astragalus detritalis*, a regional endemic plant known from two counties in Colorado and two in Utah. The site also contains the two highest quality occurrences of the *Juniperus osteosperma/Elymus salina* plant association currently known to occur and is ranked Highest National Priority.

Management Objectives If Designated -- Designation would involve a 320 acre ACEC. The site is designed to serve as a representative of this plant association in good to excellent condition and to serve as a reference study site for post-mining reclamation requirements. Fencing is recommended to exclude livestock grazing as a means of providing a baseline for comparison with grazed populations. The area would be designated for no surface occupancy, and excluded from oil shale leasing.

Multiple Use Conflicts If Designated -- The entire area is covered by six oil and gas leases which are not currently held by unit production. Due to the steep slopes, the area seldom receives livestock use. The southern portion of the area is

within wild horse range which would prohibit fencing.

Management in the Preferred Alternative -- ACEC designation would not occur for this area. No surface occupancy stipulations would be applied to ensure protection of the two *Astragalus detritalus* (debris milkvetch) populations present. The two priority *Juniperus osteosperma/Elymus salina*remnant vegetation associations C2001 and C2003 would be protected using the avoidance stipulation without affecting future oil and gas activity since the remnant vegetation associations occur on steep slopes and drilling could still occur on the adjacent flatter areas.

Soldier Creek

Significant Elements -- The site contains five populations of *Sullivantia purpusii*, four populations of *Aquilegia barnebyi* and *Thalictrum heliophilum* and two populations of *Astragalus lutosus*. The site also contains the best example of *Pseudotsuga menziesii/Symphoricarpos oreophilus/Carex geyeri-Poa fendleriana* plant association currently known to occur and is ranked Highest State Concern.

Management Objectives If Designated-- Designation would involve a 3,109 acre ACEC. The site would provide protection of a relatively undisturbed watershed with an adequate supply of water for the perpetuation of *Sullivantia purpusii* and *Aquilegia barnebyi* . This is the only recommended site containing *Sullivantia purpusii*, a plant requiring an aquatic habitat.

It is essential that all improvements and surface disturbing activities which would result in a change to the aquatic habitat and quality of the site be excluded, including the use of herbicides. This designation will have no effect on domestic livestock grazing.

Multiple Use Conflicts If Designated -- The entire area is covered by seven oil and gas leases which are not presently held by unit production.

Management in the Preferred Alternative -- Designation would involve 160 acres as an ACEC (for location, see Preferred Alternative map in the Map Addendum). The unique characteristic of this SMA is that one of the rare and sensitive plant species present is dependent upon an adequate water supply which is available within this relatively undisturbed watershed. A boundary realignment was made to facilitate potential oil and gas operations and rangeland projects, yet retain the critical habitat area for sustaining the rare and sensitive plants present. ACEC designation is recommended for the portion of this SMA with realigned boundaries within the planning area. The remaining portion of this ACEC outside this planning area has been recommended for designation during the upcoming planning effort scheduled for the adjacent area. ACEC management would emphasize maintaining watershed conditions including water quality and quantity. Rare and sensitive plant populations would be protected under application of the avoidance stipulation. ACEC designation would also benefit the Colorado River cutthroat trout, a state listed threatened species, which inhabits the lower sections of Soldier Creek.

South Cathedral Bluffs

Significant Elements -- The site contains the type locality and the largest known population in the world of *Thalictrum heliophilum*. The site contains the type locality of a new species of *Lesquerella parviflora* and the only known Colorado occurrence of *Gentianella tortuosa*. The site also contains three populations of *Aquilegia barnebyi*, two populations of *Astragalus lutosus* and a small occurrence of the *Agropyron spicatum* var. *inerme* plant association which is ranked Highest National Priority.

Management Objectives If Designated -- Designation would involve a 439 acre RNA. The site is designed for scientific study of the new taxon and to preserve the habitat of the other three rare plants which occupy the site. A monitoring program has been established for *Thalictrum heliophilum* and would need to be established for overall site trend and to study the *Lesquerella parviflora* and *Gentianella tortuosa*. The RNA designation would make the site available to colleges for research purposes. Fencing is recommended to exclude domestic livestock grazing from the area west of the ridge road. A suitable parking area and signing should be constructed on the north side of the Cathedral Bluffs access road.

The site should be withdrawn from mineral entry and excluded from leasing when present leases expire, designated for no surface occupancy, and excluded from oil shale leasing and livestock grazing.

Multiple Use Conflicts If Designated -- The entire area is covered by twelve oil and gas leases which are not held by unit production. The southern part of the site is covered by oil shale mining claims, the validity of which have not yet been determined. This site occurs within the oil shale underground mining management priority area. Designation would conflict with livestock trailing and use of the ridgetop as a utility corridor. No other adja-

cent, suitable locations occur to reroute this corridor.

Management in the Preferred Alternative -- Special Management Area designation would not occur for this area. More than 1,000 acres of this site are outside the Piceance Basin Planning Area and therefore, will not be considered in the RMP. The area outside the Piceance Basin Planning Area will be considered for special management designation through the upcoming planning effort scheduled for the adjacent area. This would include the *Thalictrum heliophilum* population to be managed as a RNA. Site-specific avoidance stipulations would protect rare and sensitive plant locations without prohibiting corridor use. Activity within the corridor would be situated away from rare and sensitive plant populations and remnant vegetation associations to the extent feasible. Fencing of selected plant populations would ensure protection of important habitats from livestock trailing and grazing. Monitoring of those fenced populations and adjacent unfenced populations would be conducted to determine impacts of grazing on the plant species and remnant vegetation association. Data from monitoring would provide the basis for future management actions in this specific location.

Spring Gulch

Significant Elements -- The site contains one population of *Aquilegia barnebyi* and two of the highest quality known occurrences of *Atriplex confertifolia/Elymus salina* plant association which is ranked Highest National Priority. The site also contains an example of the *Juniperus osteosperma-Pinus edulis/Amelanchier utahensis-Cercocarpus montanus* plant association ranked High National Concern and a small occurrence of *Artemisia tridentata* ssp. *tridentata/Elymus cinereus* plant association which is ranked High State Concern. This area contains a representative cross-section of vegetation of the northwestern margin of the basin.

Management Objectives If Designated -- Designation would involve the following:

ACEC 1,913 acres

RNA 859 acres

Total 2,772 acres

The site is designed to perpetuate the remnant vegetation associations occurring on the area and to protect the habitat of *Aquilegia barnebyi*. Partial fencing of the RNA is recommended to exclude livestock grazing where natural barriers cannot be utilized. It is intended to have an area where these plant associations are protected from grazing to provide a baseline for comparison with grazed populations.

The ACEC and RNA would be designated for no surface occupancy and excluded from oil shale leasing, as these activities would impair the ability of the area to perpetuate the significant elements it contains. The RNA portion would also be formally withdrawn from mineral entry when present leases expire and livestock grazing should be excluded.

Multiple Use Conflicts If Designated -- Nine oil and gas leases cover the entire area and are not presently held by unit production.

Management in the Preferred Alternative -- Special Management Area designation would not occur for this area. Elimination of livestock grazing is not an essential issue since minimal grazing occurs on the steep hillsides. Application of the avoidance stipulation would offer protection to the population of *Aquilegia barnebyi* (Barneby's columbine) present. The priority remnant vegetation associations F3001 and F3002 (*Atriplex confertifolia/Elymus salina*) would be protected from surface disturbing activities using the avoidance stipulation, and would also be monitored for site condition.

Upper Greasewood Creek

Significant Elements -- This site contains a high concentration of significant plant associations. The area contains three occurrences of *Pinus edulis/Amelanchier utahensis-Arctostaphylos patula-Cercocarpus montanus/Carex pityophila* plant association which is ranked Highest National Priority, two occurrences of*Juniperus osteosperma-Pinus edulis/Amelanchier utahensis-Cercocarpus montanus* association ranked High National Priority. Also one occurrence of *Artemisia tridentata spp. wyomingensis-Symphoricarpos oreophilus/Elymus cinereus* association ranked Highest State Concern and one occurrence of the *Elymus cinereus* association ranked High State Concern. The site is important as a possible site for study of comparative properties of each geologic substrate and their effects on vegetation.

Management Objectives If Designated -- Designation as an RNA on 2,435 acres. The site would serve as a reference area to compare the effects of land disturbance and domestic livestock grazing on areas of similar vegetation in northwestern Colorado and to insure perpetuation of the important plant associations in the presettlement vegetation spectrum. Therefore, it would be necessary to fence the area.

As a RNA, the area would be withdrawn from mineral entry when present leases expire, oil shale leasing would be excluded, as would livestock grazing and a no surface occupancy stipulation would be applied. The roads would be closed except those up the bottom of the east and west fork of Little Spring Creek.

Multiple Use Conflicts If Designated -- Six oil and gas leases cover 90 percent of the area and are not presently held by unit production. The plant associations identified as important receive little grazing use. However, the rest of the proposed RNA which is usable by livestock, is essential to the continuation of a yearlong cattle operation.

Management in the Preferred Alternative -- Special Management Area designation would not occur for this area. This SMA was recommended based on the high concentration of remnant vegetation associations. No rare or sensitive plants are known to occur here. Current livestock use has had little affect on the condition of these associations due to season of livestock use and unpalatability of forage present. The most effective management would be through management objectives for these plant associations during preparation of Allotment Management Plans for this area. Two priority associations C14002 (*Pinus edulis/Amelanchier utahensis-Arctostaphylos patula-Cercocarpus montanus/Carex pityophila*) and C7001 (*Juniperus osteosperma-Pinus edulis/Amelanchier utahensis-Cercocarpus montanus*) would be afforded additional management protection from surface disturbance through application of the avoidance stipulation.

Yanks Gulch

Significant Elements -- The site contains two populations of a new species, *Physaria obcordata*, a taxon which is currently being described, three populations of *Aquilegia barnebyi* and a population of *Astragalus lutosus*. The site contains some of the best examples of waterfall plunge pool complexes and unimpacted upper stream reaches in the Basin.

Management Objectives If Designated -- Designation would involve the following:

ACEC 250 acres

NSO 207 acres

Total 457 acres

The site is intended to serve as a representative of pristine waterfalls and upper stream reaches originating on the Green River formation. The site would also be utilized for monitoring of the new species, *Physaria obcordata*. The site consists of steep inaccessible slopes which should not require fencing to exclude grazing by livestock.

The site is recommended for no surface occupancy. Oil shale leasing would be excluded from the north half of the area.

Multiple Use Conflicts If Designated -- The entire area is covered by four oil and gas leases which are not presently held by unit production.

Management in the Preferred Alternative -- Special Management Area designation would not occur for this area. With no major activities in this area, use of the avoidance stipulation would adequately protect the rare and sensitive plants. Monitoring of plant sites 20W074 and 20W075 of the recently identified *Physaria obcordata* is recommended.

APPENDIX C
OFF-ROAD VEHICLE (ORV) DESIGNATIONS

Current Management Alternative

All of the Piceance Basin Planning Area would be managed in an *Open* designation. No restrictions would apply.

Wildlife Alternative (See Figure C-1)

NON-MOTORIZED HUNTING AREA -- An Area 2,000 to 5,000 acres in size within the Special Recreation Management Area (see Figure III-R1) would be designated *Limited* after further study in a Recreation Area Management Plan. This area would be located within the Cow Creek unit of the Special Recreation Management Area. It would be closed to ORV use during big game hunting seasons (approximately September through mid-November), except for prior and existing rights or special permit. The Recreation Program would implement the *Limited* designation.

SPECIAL MANAGEMENT AREAS -- Of 24,000 acres in 12 Special Management Areas, some 3,500 acres of the North and South Cathedral Bluffs and Upper Greasewood Creek Special Management Areas would be designated *Closed* to ORV use, and implemented via road and trail closures and fences. The remaining 20,500 acres would be designated *Limited*, with vehicles restricted to existing roads and trails. Prior and existing rights would be honored, and other entry would be allowed by special permit only. The Soil, Air and Water Program would implement both designations.

CRUCIAL WILDLIFE HABITAT -- An area of approximately 162,500 acres, would have a restriction on vehicular use during the months of late December through April. Only those users with prior and existing rights or special permit would be allowed entry at that time. This area would be designated LIMITED, and would have restrictions implemented by the Wildlife Program.

WATERSHEDS -- The intent for future ORV management is discussed herein. Sensitive watersheds, as identified through ongoing watershed inventories would be designated *Limited* in subsequent Watershed Management Plans, requiring vehicles to remain on existing roads and trails except for prior and existing rights and special permit. No area estimates are given for this designation at this time. The inventories are expected to be completed in 1984 and Watershed Management Plans should be completed within a few years. This limited designation would not be implemented by the Soil, Air and Water Program until that time and would therefore, be managed *Open* at this time. The method of implementation of this designation would be identified in the Watershed Management Plan.

SOILS -- Seasonal road closures would be implemented on all BLM roads and trails at the Area Manager's discretion when the road surface is saturated to a depth of 3 inches. This *Limited* designation would be implemented by the Soil, Air and Water, Oil and Gas, Oil Shale or other Programs.

All other areas would be designated OPEN.

Oil and Gas Alternative (See Figure C-2)

NON-MOTORIZED HUNTING AREA -- Same as Wildlife Alternative.

SPECIAL MANAGEMENT AREAS -- A total of 5,524 acres in the Deer Gulch, Dudley Bluffs, and South Cathedral Bluffs Special Management Areas would be designated *Limited* with vehicles required to stay on existing roads and trails. Exceptions would be made to accommodate prior and existing rights and by special permit only. The Soil, Air and Water Program would implement this designation.

SOILS -- Same as Wildlife Alternative.

All other areas would be designated *Open*.

Oil Shale Alternative (See Figure III-15)

NON-MOTORIZED HUNTING AREA -- Same as Wildlife Alternative.

All other areas would be designated *Open*.

Preferred Alternative (See Figure C-3)

NON-MOTORIZED HUNTING AREAS -- Same as Wildlife Alternative.

SPECIAL MANAGEMENT AREAS -- The Soldier Creek ACEC (160 Acres) would be closed to ORV use, except for prior and existing rights and special permit. The *Closed* designation would be implemented by the Soil, Air and Water Program.

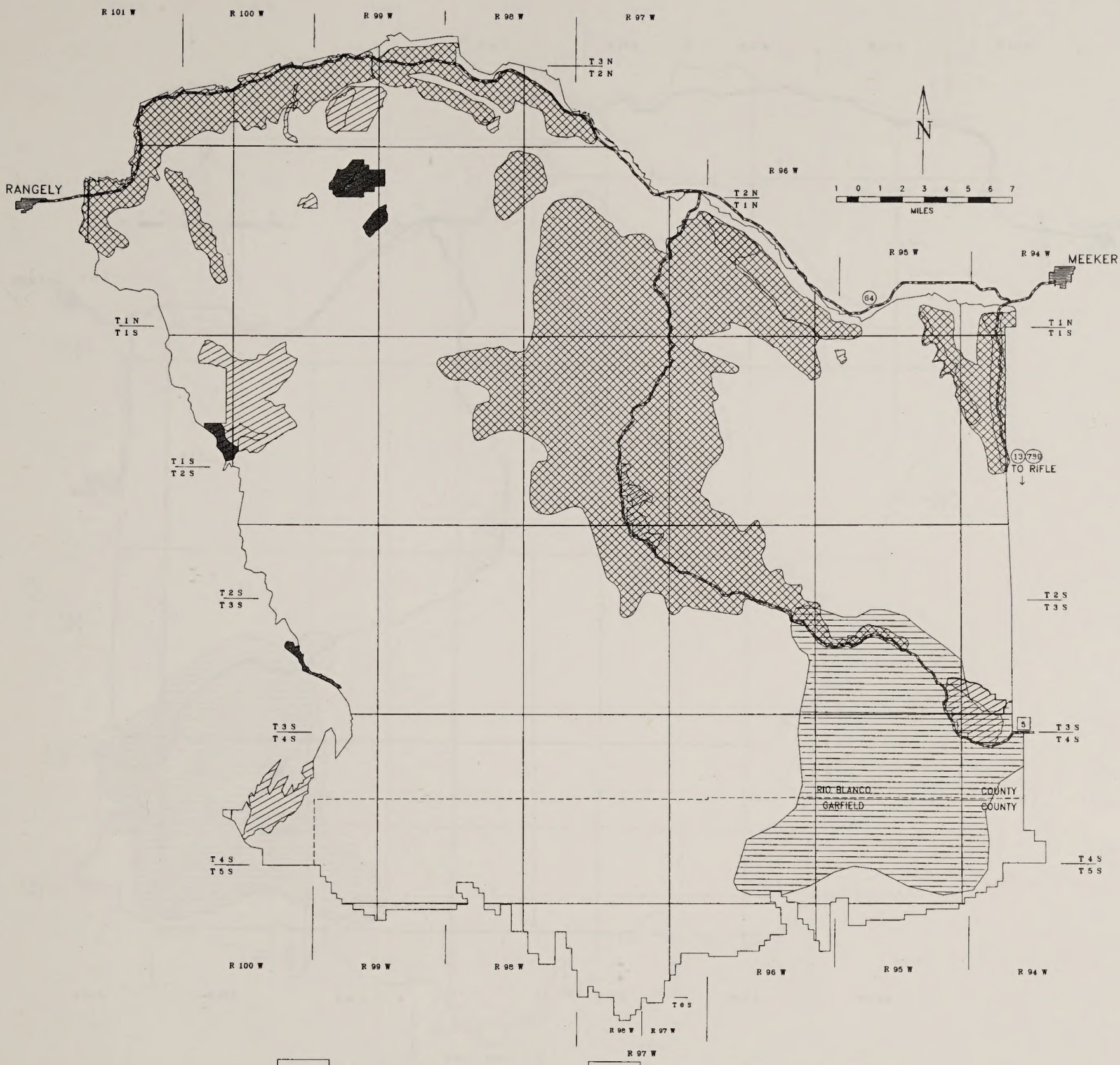
ORV DESIGNATIONS

CRUCIAL WILDLIFE HABITAT -- Same as Wildlife Alternative.

SOILS -- Same as Wildlife Alternative.

WATER SHEDS -- Same as Wildlife Alternative.

All other areas would be managed under the *Open* designation.



Open (A)

Limited (A,B)

(See "C" below) (A,C)

Closed

Limited (A,D)

A– All BLM roads subject to emergency closure when saturoted to a depth of 3 inches.

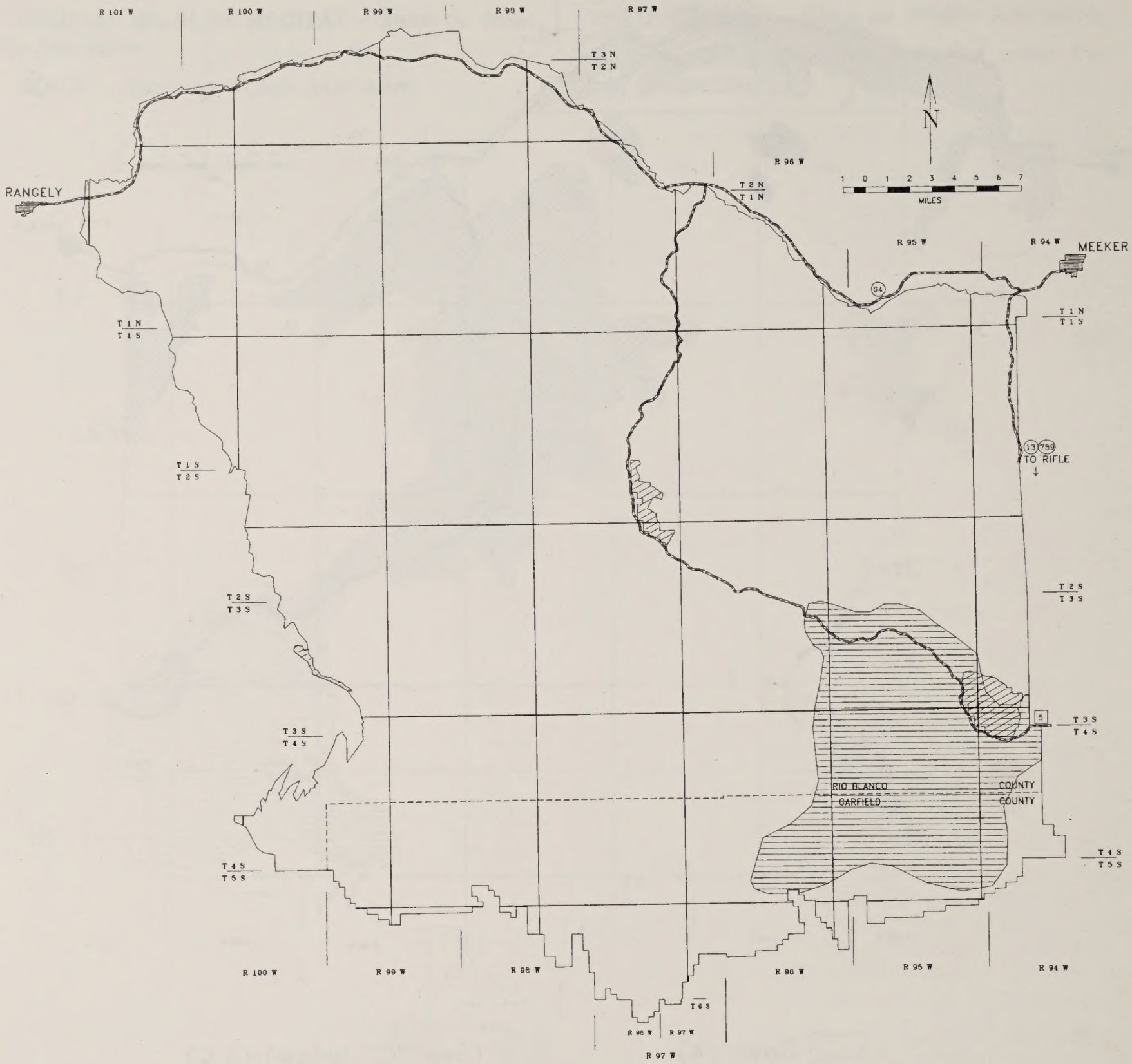
B– Seosonol rood closures for deer winter range protection opprox DEC – APRIL. Prior ond existing rights ond special permit excepted.

C– A 5,000 acre non–motorized hunting oreo to be estoblished within this unit would be designoted seosonolly LIMITED by closing roads ond trails during big gome hunting seosons (approx. 4 mos.). Special permit use excepted.

D– Vehicles permanently restricted to existing roods and troils, except for existing rights or speciol permit.

STANDARD OFF–ROAD VEHICLE DESIGNATION AREAS
WILDLIFE ALTERNATIVE

Figure C-1



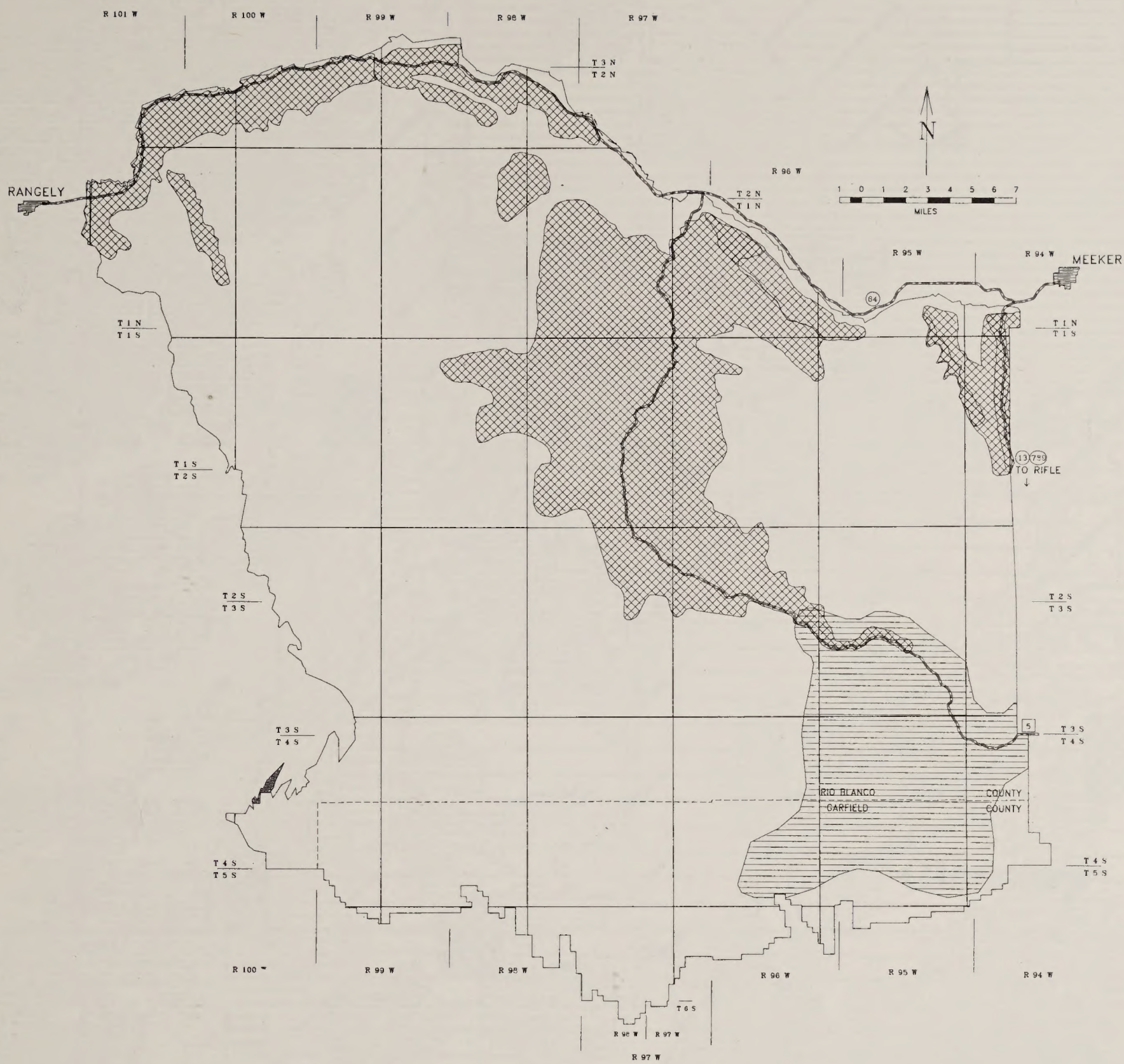
A– All BLM roads subject to emergency closure when soturated to o depth of 3 inches.

B– Vehicles permonently restricted to existing roods and trails, except for prior and existing rights or speciol permit.

C– A 5,000 ocre non–motorized hunting oreo to be estoblished within this unit would be designoted seosonally LIMITED by closing roads ond trails during big gome hunting seosons (opprox. 4 mos.). Speciol permit use excepted.

STANDARD OFF–ROAD VEHICLE DESIGNATION AREAS OIL AND GAS ALTERNATIVE

Figure C-2



A– All BLM roads subject to emergency closure when saturated to a depth of 3 inches.

B– Seasonal road closures for deer winter range protection approx DEC – APRIL. Prior and existing rights and special permit excepted.

C– A 5,000 acre non-motorized hunting area to be established within this unit would be designated seasonally LIMITED by closing roads and trails during big game hunting seasons (approx. 4 mos.). Special permit use excepted.

STANDARD OFF-ROAD VEHICLE DESIGNATION AREAS PREFERRED ALTERNATIVE

Figure C-3

Glossary

GLOSSARY

ACCIPITERS. The family of long-tailed hawks with short, rounded wings; chiefly woodland birds that do not soar.

ACTIVE NEST. An active raptor nest is one which: (a) is known to have been used by nesting raptors in at least one of the three preceeding years, or (b) is in such condition that prior use by raptors can be verified, and little or no repair will be required for its subsequent use for nesting.

AIR BASINS. These are the areas in which weak dispersion conditions result from the effects of obstructions on the normal wind flow pattern. These obstructions are elevated topographic features, such as mountain ranges or canyon walls.

ALLOTMENT. An area of land where one or more operators graze their livestock. It generally consists of public lands but may include parcels of private or state owned lands. The number of livestock and period of use are stipulated for each allotment. An allotment may consist of several pastures or be only one pasture.

ALLOTMENT MANAGEMENT PLAN (AMP). A concisely written program of livestock grazing management, including supportive measures, if required, designed to attain specific multiple use management goals in a grazing allotment.

ALLUVIAL SOIL. A soil developing from recently deposited alluvium and exhibiting essentially no horizon development or modification of the recently deposited materials.

ALLUVIUM. Clay, silt, sand, gravel, or other rock materials transported by flowing water. Deposited in comparatively recent geologic time as sorted or semisorted sediment in riverbeds, estuaries, floodplains, lakes, and shores, and in fans at the base of mountain slopes.

AMBIENT AIR QUALITY. The state of the atmosphere at ground-level as defined by the range of measured and/or predicted ambient concentrations of all significant pollutants for all averaging periods of interest.

ANIMAL UNIT MONTH (AUM). The amount of forage necessary for the subsistence of one cow or its equivalent for a period of one month.

ANTHROPOGENIC. Relating to man's activities. Anthropogenic pollutant sources include space heating, vehicular traffic, industrial activity and construction.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN (ACEC). Areas within the public lands where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historic, cultural or scenic values, fish and wildlife resources or other natural systems or processes, or to protect live and safety from natural hazards. These are not necessarily areas in which no development can occur, but limited development when wisely planned or properly managed, can take place in these areas without unduly risking life or safety or permanent damage to historic, cultural or scenic values or natural system processes.

ATMOSPHERIC DISPERSION MODEL. A mathematical simulation of the atmospheric transport and dispersion of pollutants used to predict pollutant concentrations.

BACKGROUND CONCENTRATION. A pollutant level which could be expected in an area in the absence of any anthropogenic pollutant sources.

BAGHOUSE. A stationary source pollution control system designed to filter particulates at over 99 percent efficiency.

BIOLOGICAL ASSESSMENT. A procedural step in the interagency consultation process under Section 7 of the Endangered Species Act where the BLM submits a written summary of potential project impacts to threatened or endangered species to the USFWS for their evaluation.

BRECCIA. A fragmental rock, the components of which are angular. Any rock formation essentially composed of uncemented, or loosely consolidated, small, angularly shaped fragments.

CALCINE. To expel volatile matter by heating, with or without oxidation; roasting of ore.

CANDIDATE SPECIES. Candidate species are any species not yet officially listed, but which are undergoing a status review or are proposed for listing according to *Federal Register* notices published by the Secretary of the Interior or the Secretary of Commerce. Includes three categories:

CATEGORY 1 - Taxa for which the Service presently has sufficient information on hand to support the biological appropriateness of their being listed as Endangered or Threatened species.

CATEGORY 2 - Taxa for which information now in the possession of the Service indicates the probable appropriateness of listing as Endangered or Threatened, but for which sufficient information is not presently available to biologically support a proposed rule.

CATEGORY 3 - Taxa no longer being considered for listing as Endangered or Threatened. Such Taxa are included in one of three sub-categories.

CATEGORY 3A - Taxa for which the Service has persuasive evidence of extinction.

CATEGORY 3B - Taxa for which the names, that on the basis current taxonomic understanding, do not represent taxa meeting the Endangered Species Act (16 U.S.C. 1531-1543; 87 Stat. 884), definition of "species".

CATEGORY 3C - Taxa that have proven to be more abundant or widespread than was previously believed and/or those taxa which are not subject to any identifiable threat at the present.

CANOPY COVER. See plant cover (aerial).

CARRYING CAPACITY. 1. As used to define development thresholds -- The ability of a natural or man-made system to absorb population growth or physical development without significant degradation or breakdown. 2. As used in livestock grazing discussion -- The maximum number of animals possible without inducing damage to vegetation or related resources. Carrying capacity may vary from year to year on the same area due to fluctuating forage production.

CHANNERY - Channery indicates the soil surface has between 15 and 35 percent of volume of gravel or cobble sized rock fragments (channers) that are much smaller in one dimension than in the other two dimensions. A channer is a small flagstone.

CHIMNEY DRAIN. Verticle drainage structure constructed internally within spent shale and processing waste disposal piles.

CLIMATE. The statistical collection of an area's weather conditions during a relatively long interval of time (usually several decades).

COLLUVIUM. Loose and incoherent deposits, usually at the foot of a slope or cliff and brought there chiefly by gravity. Talus and cliff debris are included in such deposits.

COMMERCIAL WOODLAND. Is a pinyon-juniper stand that must: (1) have volumes of timber, preferably pinyon, adequate for economic harvest, (2) be located on slopes less than 25 to 30 percent, and (3) be in close proximity to existing roads.

COMPOSITION. The proportions of various plant species in relation to the total in a given area.

CONTRAST. The relative difference in luminance between an object and its background. Inherent contrast is contrast as perceived at the position of the observed object. Apparent contrast is contrast as perceived at the observer's position.

CRITICAL WINTER RANGE. That area where all individuals of the species of interest are located at the point in time when distribution is most restricted over an average five winters out of ten.

DEFERRED ROTATION SYSTEM. Discontinuance of grazing on various parts of a range in succeeding years, allowing each

GLOSSARY

part to rest successively during the growing season to permit seed production, establishment of seedlings, or restoration of plant vigor.

DIP. The angle at which a bed, stratum, or vein is inclined from the horizontal plane. It may vary from a perpendicular to the earths surface to an angle perhaps only a few degrees below the horizon.

DISTILLATE. The liquid obtained by condensing a vapor.

DISPERSION POTENTIAL. The ability of the atmosphere to dilute or disperse air pollutants, as determined by normal ventilation values. A high dispersion potential results from high ventilation values, which can be caused by high transport wind speeds, high mixing heights, or high values of both.

DIURNAL. Pertains to actions that are completed over a day and night cycle.

EMISSION FACTOR. An empirically derived mathematical relationship between pollutant emission rate and some characteristic of the source such as volume, area, mass, or process output.

ENDANGERED SPECIES. Any species which is in danger of extinction throughout all or a significant portion of its range.

ENDEMIC SPECIES. A species whose natural occurrence is confined to a certain region and whose distribution is relatively limited.

EVAPORATION. The physical process by which a liquid or solid is transformed to the gaseous state.

EVAPOTRANSPIRATION. The combined loss of water from a given area during a specific period of time, by evaporation from the soil or water surface and by transpiration from plants.

FUGITIVE DUST. A type of particulate emission made airborne by forces of wind, man's activity, or both, such as unpaved roads, construction sites, tilled land, or windstorms.

GAME FISH. Any fish species for which seasons and bag limits are prescribed; fish worthy of pursuit for sport or food.

GRABEN. A depressed segment of the earths crust bounded on at least two sides by faults and generally of considerable length as compared with its width.

GRAZING CAPACITY. As used in this document, the maximum amount of livestock use permitted on an allotment per year.

GROUND COVER. The area of ground surface occupied by the stem(s) of a range plant, as contrasted with the full spread of its herbage or foliage, generally measured at one inch above soil level.

GROWING SEASON. Generally, the period of the year during which the temperature of cultivated vegetation remains sufficiently high to allow plant growth.

HABITAT. A specific set of physical conditions that surround a single species, a group of species, or a large community. In wildlife management, the major components of habitat are considered to be food, water, cover and living space.

HALITE. Impure common salt, NaCl . (sodium-choride); cubic crystals. Occurs widely disseminated or in extensive beds and irregular masses, and interstratified with rocks of other types as a true sedimentary rock.

HERBACEOUS. Green plants with leaflike appearance or texture, not including shrubs, trees, mosses, or lichens.

HERBAGE. Usually used in the same sense as forage, except that it may include material not acceptable to grazing or browsing animals.

HABITAT EFFECTIVENESS. The actual capability of a habitat site to support a wildlife population. It is determined by calculating the total productive potential minus any natural or man-caused impacts or factors which make an area to be less than fully effective for wildlife use.

HYDROCARBON. A chemical compound comprised principally of carbon and hydrogen, but also containing varying amounts of other elements (i.e., sulfur, nitrogen, chlorine).

INDIRECT IMPACTS. Impacts caused by something which, itself, is a result of something else. In economics, indirect impacts are caused by growth in trade and service activities which, themselves, result from a primary source of growth such as mining.

INHALABLE PARTICULATES. Particles less than 10 microns in diameter which are not filtered in the nostrils and can be lodged in the lungs causing health damage.

INTERFACE. As used in this document, contact boundary either between spent shale wastes and native rock or soil. Could be the boundary between differing layers of spent shale.

IRRIGATED PASTURE LAND AND HAYLAND OF STATEWIDE IMPORTANCE. These are lands which for one or more reasons, do not meet the requirements for prime farmland. However, lands in this category are important to the agricultural economy in Colorado.

JOINT FREQUENCY DISTRIBUTION. Set of meteorological data describing the concurrent frequencies of occurrence of defined wind directions, wind speed classes, and atmospheric stabilities.

MASS WASTING. The movement of rock debris downslope in large masses of material moving either quickly or slowly from one place to another.

METER. The basic metric unit of lengths; one meter is equivalent to 3.28 feet.

MIXING HEIGHT. The height above the ground to which turbulence causes the air to be well mixed.

MODELING. A mathematical or physical representation of an observable situation. In air pollution control, models afford the ability to predict pollutant distribution or dispersion from identified sources for specified weather conditions.

MOLYBDENOSIS. Molybdenum poisoning is the consumption of forage on soils of a molybdenum-copper inbalance of sufficient quantity to provide toxic results to ruminents. Prominent symptoms in cattle include emaciation, scours, anemia, stiffness, reproductive difficulty and occasionally death.

NATURAL AREA. A physical and biological area which either retains or has reestablished its natural character, although it need not be completely undisturbed, and which typifies native vegetation and associated biological and geological features or provides habitat for rare or endangered animal or plant species or includes geologic or other natural features of scientific or educational value.

NEPHELOMETER. An instrument which measures the scattering coefficient of an air sample which can be interpreted as visual range.

OPERATOR. See permittee.

OUTSTANDING NATURAL AREA. As defined in 43 CFR 2071.1 and 43 CFR 6225.0-5, means an area established to preserve scenic values and areas of natural wonder. The preservation of these sources in their natural condition is the primary management objective.

OVERSTORY. That portion of a plant community that is dominant as to height; the tallest plants on a given site.

PASQUILL STABILITY CLASS E. The stability category which corresponds to nightime meteorological conditions with less than 3/8 cloud cover and surface winds between 2 and 5 meters per second.

PASSERINE. The order and classification of perching birds.

PASTURE. A subdivision of a grazing allotment on public lands. The number of pastures is variable between allotments.

PERMITTEE. Holder of a license or permit for grazing on an allotment.

pH. A measure of the acidity or alkalinity of a solution. Water is considered to be neutral at a pH of 7, acidic if pH is less than 7, and basic if greater than 7.

PHOTOCHEMICAL REACTION. Chemical reaction in which the activation energy (driving force) is supplied by solar radiation.

PLANT COVER. The percent of an area covered by any part of living plant material (aerial plant cover), or that percent area occupied by the portion of living plants at the point of emergence from the ground (basal plant cover).

POINT SOURCE. A pollutant source whose origin of emissions can be approximated by a single point.

GLOSSARY

POLLUTANT. Any gaseous, chemical, or organic waste that contaminates air, soil, or water.

POLLUTION. The contamination of soil, water, or the atmosphere by the discharge of noxious substances.

PREVAILING WIND. The most frequent compass direction from which the wind blows.

PRIME FARMLAND. In general, prime farmlands in Colorado have an adequate and dependable water supply from irrigation (a dependable water supply is one in which enough water is available for irrigation in 8 out of 10 years, for crops commonly grown); a favorable temperature and growing season; acceptable acidity or alkalinity; acceptable salt and sodium content; and few or no rocks. They are permeable to water and air. Prime Farmlands are not excessively erodible or saturated with water for long periods of time and they either do not flood frequently or are protected from flooding.

RADIATIONAL COOLING. The cooling of the earth's surface and adjacent air, accomplished (mainly at night) whenever the earth's surface suffers a net loss of heat.

RADIOMETER. An instrument which measures the apparent radiance of a target and its apparent background radiance which can be interpreted as visual range.

RANGE SITE. A type of rangeland with inherently different soil characteristics that produce a significantly different kind or amount of potential vegetation.

RAPTOR. Birds of prey with sharp talons and strongly curved beaks; e.g., hawks, owls, eagles, falcons.

RECREATION DAY. The presence of one person on an area of land or water for the purpose of engaging in one or more recreational activities during all or part of a calendar day.

REGIONAL VISIBILITY. Visibility predicted to occur in the region around a source or group of sources resulting from particulate, sulfate, and nitrate concentrations in the vicinity of these sources.

RESEARCH NATURAL AREAS. As defined in 43 CFR 8223.0-5, means an area that is established and maintained for the primary purpose of research and education because the land has one or more of the following characteristics:

1) A typical representation of a common plant or animal association;
2) An unusual plant or animal association;
3) A threatened or endangered plant or animal species;
4) A typical representation of common geologic, soil or water features; or
5) Outstanding or unusual geologic, soil or water features.

RETORT. A vessel used for solid to liquid distillation of oil shale by applying indirect or direct heat. Can occur in above ground facilities or below ground in place.

RILL. A small intermittent water course with steep sides, less than 6 inches deep.

RIPARIAN. Situated on or pertaining to the bank of a river, stream, or other body of water. Normally used to refer to the plants of all types that grow rooted in the watertable of streams, ponds, and springs.

SECONDARY IMPACTS. See INDIRECT IMPACTS.

SENSITIVE SPECIES. A species included on the sensitive species list developed by the Colorado State Office pursuant to section CL of Instruction Memorandum No. 80-722 and approved by the State Director. These lists will generally include any species in the State which meet any of the following criteria:

a. Candidate species are any species not yet officially listed but which are undergoing a status review or are proposed for listing according to Federal Register notices published by the Secretary of the Interior or the Secretary of Commerce.

b. Rare or infrequent species whose populations are consistently small and widely dispersed, or whose ranges are restricted to a few localities, such that any appreciable reduction in numbers, habitat, or habitat condition might lead toward extinction.

c. Other species whose numbers are declining so rapidly that official listing may become necessary as a conservation measure. Declines may be the result of one or more of several factors including: overuse for commercial, scientific, or educational purposes; disease, predation, or grazing; the inadequacy of existing regulatory mechanisms; and/or other natural or human factors adversely affecting the species continued existence.

SHEET EROSION. The removal of a fairly uniform layer of soil from the land surface by runoff water.

SLOPE FAILURE. Downward and outward movement of material in an unconsolidated mass; (slumped); material that has slid down from a higher position on a slope.

SOIL HORIZON. A layer of soil, approximately parallel to the soil surface, with comparatively uniform characteristics.

SPECIAL CONCERN. Those plants that are considered rare within Colorado but may be common in occurrence within other states and/or there is at present insufficient justification for these plant species to be included on the Sensitive Plant Species list.

SPECIES. An organism which is, and remains, distinct because it does not normally interbreed with other organisms.

STRATIGRAPHY. Descriptive geology of an area or district which pertains to the discrimination, character, thickness, sequence, age, and correlation of the rocks.

STRATOSPHERIC. Pertaining to the stratosphere, the atmospheric layer above the tropopause; a very stable layer characterized by low moisture content and absence of clouds.

SYNOPTIC. Weather patterns associated with high and low pressure systems in the lower troposphere.

THREATENED SPECIES. Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

THORACIC PARTICULATES. Particles less than 15 microns in diameter which are not filtered in the nostrils and can be lodged in the windpipe and lungs causing health damage.

TOPOGRAPHY. The exact physical features and configuration of a place or region; the detailed and accurate description of a place or region.

TOPSOIL. Fertile soil or soil material, usually rich in organic matter, used to top-dress disturbed areas. Topsoil is better suited to supporting plants than other material.

TOTAL SUSPENDED PARTICULATES (TSP). The portion of the total particulate matter in the atmosphere consisting of particles so small that the particles settle out very slowly.

TRANSPORT WIND. The average horizontal wind speed component perpendicular to a vertical cross section of the atmosphere. In this report, the vertical limits are defined by the ground and the mixing height.

UNDERSTORY. That portion of a plant community that grows underneath taller plants growing on the same site.

UNIQUE FARMLAND. Unique Farmland is land other than Prime Farmland that is used for the production of specific high value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality and/or high yield of a specific crop, when treated and managed according to acceptable farming methods. In Colorado only fruit orchards and vegetable producing areas of high production are considered unique.

VEGETATION TYPE. A plant community with immediately distinguishable characteristics, based upon and named after the apparent dominant plant species.

VISIBILITY. A measurement of the maximum distance to which large objects may be viewed. Fixed reference objects such as mountains, hills, towers, or buildings are normally used to estimate visibility.

VISUAL RANGE. A standardized form of visibility that approximates actual observed visibility. It is the maximum distance at which an average human eye with a threshold perceivable brightness contrast of .02 at a wavelength of 5,500 Angstroms can detect an ideal black object against the horizon sky in daylight.

GLOSSARY

VISUAL RESOURCE MANAGEMENT CLASSES. The degree of acceptable visual change within a characteristic landscape. A class is based upon the physical and sociological characteristics of any given homogeneous area and serves as a management objective.

CLASS I. Areas (preservation) provided for natural ecological changes only. This class includes primitive areas, some natural areas, some wild and scenic rivers, and other similar sites where landscape modification activities should be restricted.

CLASS II. (partial retention of the landscape character) includes areas where changes in any of the basic elements (form, line, color, or texture) caused by a management activity should not be evident in the characteristic landscape.

CLASS III. (partial retention of the landscape character) includes areas where changes in the basic elements (form, line, color, or texture) caused by a management activity may be evident in the characteristic landscape. However, the changes should remain subordinate to the visual strength of the existing characteristic landscape.

CLASS IV. (modification of the landscape character) includes areas where changes may subordinate the original composition and character; however, they should reflect what could be a natural occurrence within the characteristic landscape.

CLASS V. (rehabilitation or enhancement of the landscape character) includes areas where change is needed. This class would apply to areas where the quality class has been reduced because of unacceptable intrusions. It should be considered an interim short-term classification until one of the other classes can be reached through rehabilitation or enhancement.

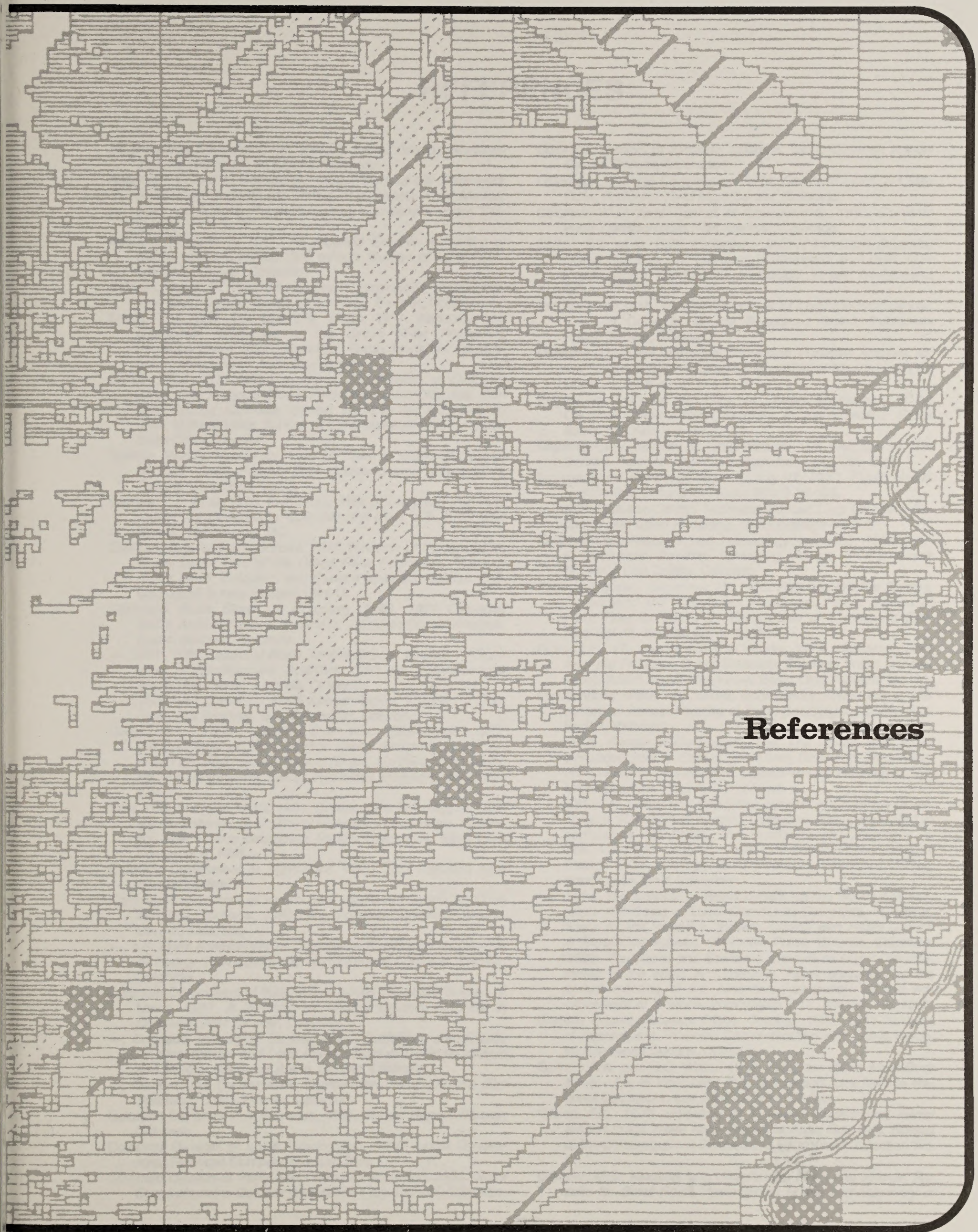
WET ADIABATIC LAPSE RATE. The standard rate of decreasing temperature of moist air with increasing altitude (at constant energy).

WIND ROSE. A graphical display of wind speed and wind direction frequencies at a meterological station. The bar graphs extend into the direction from which the wind blows. These directions are the sixteen compass point directions (i.e., north, north-northeast, ..., northwest, and north-northwest).

WINTER RANGE. That area where all individuals of the species of interest are located for over an average of five winters out of ten during the period 15 December to 15 March.

LIST OF ABBREVIATIONS

ACEC: Area of Critical Environmental Concern
AQRV: Air Quality Related Values
AUM: Animal Unit Month
BACT: Best Available Control Technology
bbl/day: barrels per day
$^{\circ}C$: degrees Centigrade
C-a: Rio Blanco Oil Shale Tract
C-b: Cathedral Bluffs Shale Oil Tract
cfs cubic feet per second
cm: centimeter
CO: Carbon Monoxide
EIS: Environmental Impact Statement
$^{\circ}F$: degrees Fahrenheit
gm/sec: grams per second
KGS: Known Geologic Structure
km: kilometer
m: meter
mb: millibar
Mcf: 1,000 cubic feet
mg/l: milligrams per liter
m/s: meters per second
NEPA: National Environmental Policy Act
NM: National Monument
NMHC: Non-Methane Hydrocarbons
NO_2: Nitrogen Dioxide
NO_x: Oxides of Nitrogen
NPDES: National Pollutant Discharge Elimination System
O_3: Ozone
ONA: Outstanding Natural Area
ORV: Off-Road Vehicles
PM_{10}: Inhalable Particulates
PSD: Prevention of Significant Deterioration
R&PP: Recreation and Public Purposes
RNA: Research Natural Area
ROS: Recreation Opportunity Spectrum
SMA: Special Management Area
SO_2: Sulfur Dioxide
SRMA: Special Recreation Management Area
T_{15}: Thoracic particulates (less than 15 microns)
TAPAS: Topographic Air Pollution Analysis System
TDS: total dissolved solids
TGF: Tight Gas Formation
TSP: Total Suspended Particulates



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